

Guide to Thinking Forex plus Bitcoin

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Foreign exchange market

The foreign exchange market (Forex, FX, or currency market) is a global decentralized or over-the-counter (OTC) market for the trading of currencies. This market determines the foreign exchange rate. It includes all aspects of buying, selling and exchanging currencies at current or determined prices. In terms of trading volume, it is by far the largest market in the world, followed by the Credit market.

The main participants in this market are the larger international banks. Financial centers around the world function as anchors of trading between a wide range of multiple types of buyers and sellers around the clock, with the exception of weekends. Since currencies are always traded in pairs, the foreign exchange market does not set a currency's absolute value but rather determines its relative value by setting the market price of one currency if paid for with another. Ex: 1 USD is worth X CAD, or CHF, or JPY, etc..

The foreign exchange market works through financial institutions, and operates on several levels. Behind the scenes, banks turn to a smaller number of financial firms known as "dealers", who are involved in large quantities of foreign exchange trading. Most foreign exchange dealers are banks, so this behind-the-scenes market is sometimes called the "interbank market" (although a few insurance companies and other kinds of financial firms are involved). Trades between foreign exchange dealers can be very large, involving hundreds of millions of dollars. Because of the sovereignty issue when involving two currencies, Forex has little (if any) supervisory entity regulating its actions.

The foreign exchange market assists international trade and investments by enabling currency conversion. For example, it permits a business in the United States to import goods from European Union member states, especially Eurozone members, and pay Euros, even though its income is in United States dollars. It also supports direct speculation and evaluation relative to the value of currencies and the carry trade speculation, based on the differential interest rate between two currencies.

In a typical foreign exchange transaction, a party purchases some quantity of one currency by paying with some quantity of another currency.

The modern foreign exchange market began forming during the 1970s. This followed three decades of government restrictions on foreign exchange transactions under

the Bretton Woods system of monetary management, which set out the rules for commercial and financial relations among the world's major industrial states after World War II. Countries gradually switched to floating exchange rates from the previous exchange rate regime, which remained fixed per the Bretton Woods system.

The foreign exchange market is unique because of the following characteristics:

- its huge trading volume, representing the largest asset class in the world leading to high liquidity;
- its geographical dispersion;
- its continuous operation: 24 hours a day except weekends, i.e., trading from 22:00 GMT on Sunday (Sydney) until 22:00 GMT Friday (New York);
- the variety of factors that affect exchange rates;
- the low margins of relative profit compared with other markets of fixed income; and
- the use of leverage to enhance profit and loss margins and with respect to account size.

As such, it has been referred to as the market closest to the ideal of perfect competition, notwithstanding currency intervention by central banks.

According to the Bank for International Settlements, the preliminary global results from the 2016 Triennial Central Bank Survey of Foreign Exchange and OTC Derivatives Markets Activity show that trading in foreign exchange markets averaged \$5.09 trillion per day in April 2016. This is down from \$5.4 trillion in April 2013 but up from \$4.0 trillion in April 2010. Measured by value, foreign exchange swaps were traded more than any other instrument in April 2016, at \$2.4 trillion per day, followed by spot trading at \$1.7 trillion.

The \$5.09 trillion break-down is as follows:

- \$1.654 trillion in spot transactions
- \$700 billion in outright forwards
- \$2.383 trillion in foreign exchange swaps
- \$96 billion currency swaps
- \$254 billion in options and other products
- Currency trading and exchange first occurred in ancient times. Money-changers (people helping others to change money and also taking a commission or charging a fee) were living in the Holy Land in the times of the Talmudic writings (*Biblical times*). These people (sometimes called "kollybistēs") used city stalls, and at feast times the Temple's Court of the

Gentiles instead. Money-changers were also the silversmiths and/or goldsmiths of more recent ancient times.

- During the 4th century AD, the Byzantine government kept a monopoly on the exchange of currency.
- Papyri PCZ I 59021 (c.259/8 BC), shows the occurrences of exchange of coinage in Ancient Egypt.
- Currency and exchange were important elements of trade in the ancient world, enabling people to buy and sell items like food, pottery and raw materials. If a Greek coin held more gold than an Egyptian coin due to its size or content, then a merchant could barter fewer Greek gold coins for more Egyptian ones, or for more material goods. This is why, at some point in their history, most world currencies in circulation today had a value fixed to a specific quantity of a recognized standard like silver and gold.

During the 15th century, the Medici family were required to open banks at foreign locations in order to exchange currencies to act on behalf of textile merchants. To facilitate trade, the bank created the *nostro* (from Italian, this translates to "ours") account book which contained two columned entries showing amounts of foreign and local currencies; information pertaining to the keeping of an account with a foreign bank. During the 17th (or 18th) century, Amsterdam maintained an active Forex market. In 1704, foreign exchange took place between agents acting in the interests of the Kingdom of England and the County of Holland.

Alex. Brown & Sons traded foreign currencies around 1850 and was a leading currency trader in the USA. In 1880, J.M. do Espírito Santo de Silva (Banco Espírito Santo) applied for and was given permission to engage in a foreign exchange trading business.

The year 1880 is considered by at least one source to be the beginning of modern foreign exchange: the gold standard began in that year.

Prior to the First World War, there was a much more limited control of international trade. Motivated by the onset of war, countries abandoned the gold standard monetary system.

From 1899 to 1913, holdings of countries' foreign exchange increased at an annual rate of 10.8%, while holdings of gold increased at an annual rate of 6.3% between 1903 and 1913.

At the end of 1913, nearly half of the world's foreign exchange was conducted using the pound sterling. The number of foreign banks operating within the boundaries of London increased from 3 in 1860, to 71 in 1913. In 1902, there were just two London foreign exchange brokers. At the start of the 20th century, trades in currencies was most active in Paris, New York City and Berlin; Britain remained largely uninvolved until 1914. Between 1919 and 1922, the number of foreign exchange brokers in London increased to 17; and in 1924, there were 40 firms operating for the purposes of exchange.

During the 1920s, the Kleinwort family were known as the leaders of the foreign exchange market, while Japheth, Montagu & Co. and Seligman still warrant recognition as significant FX traders. The trade in London began to resemble its modern manifestation. By 1928, Forex trade was integral to the financial functioning of the city. Continental exchange controls, plus other factors in Europe and Latin America, hampered any attempt at wholesale prosperity from trade for those of 1930s London.

In 1944, the Bretton Woods Accord was signed, allowing currencies to fluctuate within a range of $\pm 1\%$ from the currency's par exchange rate. In Japan, the Foreign Exchange Bank Law was introduced in 1954. As a result, the Bank of Tokyo became the center of foreign exchange by September 1954. Between 1954 and 1959, Japanese law was changed to allow foreign exchange dealings in many more Western currencies.

U.S. President, Richard Nixon is credited with ending the Bretton Woods Accord and fixed rates of exchange, eventually resulting in a free-floating currency system. After the Accord ended in 1971, the Smithsonian Agreement allowed rates to fluctuate by up to $\pm 2\%$. In 1961–62, the volume of foreign operations by the U.S. Federal Reserve was relatively low. Those involved in controlling exchange rates found the boundaries of the Agreement were not realistic and so ceased this in March 1973, when sometime afterward none of the major currencies were maintained with a capacity for conversion to gold organizations relied instead on reserves of currency. From 1970 to 1973, the volume of trading in the market increased three-fold. At some time (according to *Gandolfo* during February–March 1973) some of the markets were "split", and a two-tier currency market was subsequently introduced, with dual currency rates. This was abolished in March 1974.

Reuters introduced computer monitors during June 1973, replacing the telephones and telex used previously for trading quotes.

Due to the ultimate ineffectiveness of the Bretton Woods Accord and the European Joint Float, the forex markets were forced to close sometime during 1972 and March

1973. The very largest purchase of US dollars in the history of 1976 was when the West German government achieved an almost 3 billion dollar acquisition (a figure given as 2.75 billion in total by *The Statesman*: Volume 18 1974), this event indicated the impossibility of the balancing of exchange stabilities by the measures of control used at the time and the monetary system and the foreign exchange markets in "West" Germany and other countries within Europe closed for two weeks (during February and, or, March 1973. *Giersch, Paqué, & Schmieding* state closed after purchase of "7.5 million Dmarks" *Brawley* states "... Exchange markets had to be closed. When they re-opened ... March 1 " that is a large purchase occurred after the close).

In developed nations, the state control of the foreign exchange trading ended in 1973 when complete floating and relatively free market conditions of modern times began. Other sources claim that the first time a currency pair was traded by U.S. retail customers was during 1982, with additional currency pairs becoming available by the next year.

On 1 January 1981, as part of changes beginning during 1978, the People's Bank of China allowed certain domestic "enterprises" to participate in foreign exchange trading. Sometime during 1981, the South Korean government ended Forex controls and allowed free trade to occur for the first time. During 1988, the country's government accepted the IMF quota for international trade.

Intervention by European banks influenced the Forex market on 27 February 1985. The greatest proportion of all trades worldwide during 1987 were within the United Kingdom (slightly over one quarter). The United States had the second amount of places involved in trading.

During 1991, Iran changed international agreements with some countries from oil-barter to foreign exchange.

The foreign exchange market is the most liquid financial market in the world. Traders include governments and central banks, commercial banks, other institutional investors and financial institutions, currency speculators, other commercial corporations, and individuals. The average daily turnover in the global foreign exchange and related markets is continuously growing. According to the 2010 Triennial Central Bank Survey, coordinated by the Bank for International Settlements, average daily turnover was \$3.98 trillion in April 2010 (compared to \$1.7 trillion in 1998). Of this \$3.98 trillion, \$1.5 trillion was spot transactions and \$2.5 trillion was traded in outright forwards, swaps, and other derivatives.

In April 2010, trading in the United Kingdom accounted for 36.7% of the total, making it by far the most important centre for foreign exchange trading in the world. Trading in the United States accounted for 17.9% and Japan accounted for 6.2%.

For the first time ever, Singapore surpassed Japan in average daily foreign-exchange trading volume in April 2013 with \$383 billion per day. So the order became: United Kingdom (41%), United States (19%), Singapore (6%), Japan (6%) and Hong Kong (4%).

Turnover of exchange-traded foreign exchange futures and options has grown rapidly in recent years, reaching \$166 billion in April 2010 (double the turnover recorded in April 2007). As of April 2016, exchange-traded currency derivatives represent 2% of OTC foreign exchange turnover. Foreign exchange futures contracts were introduced in 1972 at the Chicago Mercantile Exchange and are traded more than to most other futures contracts.

Most developed countries permit the trading of derivative products (such as futures and options on futures) on their exchanges. All these developed countries already have fully convertible capital accounts. Some governments of emerging markets do not allow foreign exchange derivative products on their exchanges because they have capital controls. The use of derivatives is growing in many emerging economies. Countries such as South Korea, South Africa, and India have established currency futures exchanges, despite having some capital controls.

Foreign exchange trading increased by 20% between April 2007 and April 2010, and has more than doubled since 2004. The increase in turnover is due to a number of factors: the growing importance of foreign exchange as an asset class, the increased trading activity of high-frequency traders, and the emergence of retail investors as an important market segment. The growth of electronic execution and the diverse selection of execution venues has lowered transaction costs, increased market liquidity, and attracted greater participation from many customer types. In particular, electronic trading via online portals has made it easier for retail traders to trade in the foreign exchange market. By 2010, retail trading was estimated to account for up to 10% of spot turnover, or \$150 billion per day.

Foreign exchange is traded in an over-the-counter market where brokers/dealers negotiate directly with one another, so there is no central exchange or clearing house. The biggest geographic trading center is the United Kingdom, primarily London. According to TheCityUK, it is estimated that London increased its share of global turnover in traditional transactions from 34.6% in April 2007 to 36.7% in April 2010. Due to London's dominance in the market, a particular currency's quoted price is usually the London market price. For instance, when the International Monetary

Fund calculates the value of its special drawing rights every day, they use the London market prices at noon that day.

Unlike a stock market, the foreign exchange market is divided into levels of access. At the top is the interbank foreign exchange market, which is made up of the largest commercial banks and securities dealers. Within the interbank market, spreads, which are the difference between the bid and ask prices, are razor sharp and not known to players outside the inner circle. The difference between the bid and ask prices widens (for example from 0 to 1 pip to 1–2 pips for currencies such as the EUR) as you go down the levels of access. This is due to volume. If a trader can guarantee large numbers of transactions for large amounts, they can demand a smaller difference between the bid and ask price, which is referred to as a better spread. The levels of access that make up the foreign exchange market are determined by the size of the "line" (the amount of money with which they are trading). The top-tier interbank market accounts for 51% of all transactions. From there, smaller banks, followed by large multi-national corporations (which need to hedge risk and pay employees in different countries), large hedge funds, and even some of the retail market makers. According to Galati and Melvin, "Pension funds, insurance companies, mutual funds, and other institutional investors have played an increasingly important role in financial markets in general, and in FX markets in particular, since the early 2000s." (2004) In addition, he notes, "Hedge funds have grown markedly over the 2001–2004 period in terms of both number and overall size". Central banks also participate in the foreign exchange market to align currencies to their economic needs.

An important part of the foreign exchange market comes from the financial activities of companies seeking foreign exchange to pay for goods or services. Commercial companies often trade fairly small amounts compared to those of banks or speculators, and their trades often have little short-term impact on market rates. Nevertheless, trade flows are an important factor in the long-term direction of a currency's exchange rate. Some multinational corporations (MNCs) can have an unpredictable impact when very large positions are covered due to exposures that are not widely known by other market participants.

National central banks play an important role in the foreign exchange markets. They try to control the money supply, inflation, and/or interest rates and often have official or unofficial target rates for their currencies. They can use their often substantial foreign exchange reserves to stabilize the market. Nevertheless, the effectiveness of central bank "stabilizing speculation" is doubtful because central banks do not go bankrupt if they make large losses, like other traders would. There is also no convincing evidence that they actually make a profit from trading.

Foreign exchange fixing is the daily monetary exchange rate fixed by the national bank of each country. The idea is that central banks use the fixing time and exchange rate to evaluate the behavior of their currency. Fixing exchange rates reflect the real value of equilibrium in the market. Banks, dealers and traders use fixing rates as a market trend indicator.

The mere expectation or rumor of a central bank foreign exchange intervention might be enough to stabilize a currency. However, aggressive intervention might be used several times each year in countries with a dirty float currency regime. Central banks do not always achieve their objectives. The combined resources of the market can easily overwhelm any central bank. Several scenarios of this nature were seen in the 1992–93 European Exchange Rate Mechanism collapse, and in more recent times in Asia.

Investment management firms (who typically manage large accounts on behalf of customers such as pension funds and endowments) use the foreign exchange market to facilitate transactions in foreign securities. For example, an investment manager bearing an international equity portfolio needs to purchase and sell several pairs of foreign currencies to pay for foreign securities purchases.

Some investment management firms also have more speculative specialist currency overlay operations, which manage clients' currency exposures with the aim of generating profits as well as limiting risk. While the number of this type of specialist firms is quite small, many have a large value of assets under management and can therefore generate large trades.

Individual retail speculative traders constitute a growing segment of this market with the advent of retail foreign exchange trading, both in size and importance. Currently, they participate indirectly through brokers or banks. Retail brokers, while largely controlled and regulated in the USA by the Commodity Futures Trading Commission and National Futures Association, have previously been subjected to periodic foreign exchange fraud. To deal with the issue, in 2010 the NFA required its members that deal in the Forex markets to register as such (I.e., Forex CTA instead of a CTA). Those NFA members that would traditionally be subject to minimum net capital requirements, FCMs and IBs, are subject to greater minimum net capital requirements if they deal in Forex. A number of the foreign exchange brokers operate from the UK under Financial Services Authority regulations where foreign exchange trading using margin is part of the wider over-the-counter derivatives trading industry that includes contracts for difference and financial spread betting.

There are two main types of retail FX brokers offering the opportunity for speculative currency trading: *brokers* and *dealers* or *market makers*. *Brokers* serve as an agent of

the customer in the broader FX market, by seeking the best price in the market for a retail order and dealing on behalf of the retail customer. They charge a commission or "mark-up" in addition to the price obtained in the market. *Dealers* or *market makers*, by contrast, typically act as principals in the transaction versus the retail customer, and quote a price they are willing to deal at.

Non-bank foreign exchange companies offer currency exchange and international payments to private individuals and companies. These are also known as "foreign exchange brokers" but are distinct in that they do not offer speculative trading but rather currency exchange with payments (i.e., there is usually a physical delivery of currency to a bank account).

It is estimated that in the UK, 14% of currency transfers/payments are made via Foreign Exchange Companies. These companies' selling point is usually that they will offer better exchange rates or cheaper payments than the customer's bank. These companies differ from Money Transfer/Remittance Companies in that they generally offer higher-value services. The volume of transactions done through Foreign Exchange Companies in India amounts to about USD 2 billion per day. This does not compete favorably with any well developed foreign exchange market of international repute, but with the entry of online Foreign Exchange Companies the market is steadily growing. Around 25% of currency transfers/payments in India are made via non-bank Foreign Exchange Companies. Most of these companies use the USP of better exchange rates than the banks. They are regulated by FEDAI and any transaction in foreign Exchange is governed by the Foreign Exchange Management Act, 1999 (FEMA).

Money transfer companies/remittance companies perform high-volume low-value transfers generally by economic migrants back to their home country. In 2007, the Aite Group estimated that there were \$369 billion of remittances (an increase of 8% on the previous year). The four largest markets (India, China, Mexico and the Philippines) receive \$95 billion. The largest and best known provider is Western Union with 345,000 agents globally, followed by UAE Exchange. Bureaux de change or currency transfer companies provide low value foreign exchange services for travelers. These are typically located at airports and stations or at tourist locations and allow physical notes to be exchanged from one currency to another. They access the foreign exchange markets via banks or non bank foreign exchange companies.

There is no unified or centrally cleared market for the majority of trades, and there is very little cross-border regulation. Due to the over-the-counter (OTC) nature of currency markets, there are rather a number of interconnected marketplaces, where different currencies instruments are traded. This implies that there is not a *single* exchange rate but rather a number of different rates (prices), depending on

what bank or market maker is trading, and where it is. In practice, the rates are quite close due to arbitrage. Due to London's dominance in the market, a particular currency's quoted price is usually the London market price. Major trading exchanges include Electronic Broking Services (EBS) and Thomson Reuters Dealing, while major banks also offer trading systems. A joint venture of the Chicago Mercantile Exchange and Reuters, called Fxmarketspace opened in 2007 and aspired but failed to the role of a central market clearing mechanism .

The main trading centers are London and New York City, though Tokyo, Hong Kong and Singapore are all important centers as well. Banks throughout the world participate. Currency trading happens continuously throughout the day; as the Asian trading session ends, the European session begins, followed by the North American session and then back to the Asian session.

Fluctuations in exchange rates are usually caused by actual monetary flows as well as by expectations of changes in monetary flows. These are caused by changes in gross domestic product (GDP) growth, inflation (purchasing power parity theory), interest rates (interest rate parity, Domestic Fisher effect, International Fisher effect), budget and trade deficits or surpluses, large cross-border M&A deals and other macroeconomic conditions. Major news is released publicly, often on scheduled dates, so many people have access to the same news at the same time. However, the large banks have an important advantage.

Currencies are traded against one another in pairs. Each currency pair thus constitutes an individual trading product and is traditionally noted XXXYYY or XXX/YYY, where XXX and YYY are the ISO 4217 international three-letter code of the currencies involved. The first currency (XXX) is the base currency that is quoted relative to the second currency (YYY), called the counter currency (or quote currency). For instance, the quotation *EURUSD (EUR/USD) 1.5465* is the price of the Euro expressed in US dollars, meaning 1 euro = 1.5465 dollars. The market convention is to quote most exchange rates against the USD with the US dollar as the base currency (e.g. USDJPY, USDCAD, USDCHF). The exceptions are the British pound (GBP), Australian dollar (AUD), the New Zealand dollar (NZD) and the euro (EUR) where the USD is the counter currency (e.g. GBPUSD, AUDUSD, NZDUSD, EURUSD).

The factors affecting XXX will affect both XXXYYY and XXXZZZ. This causes positive currency correlation between XXXYYY and XXXZZZ.

On the spot market, according to the 2016 Triennial Survey, the most heavily traded bilateral currency pairs were:

- EURUSD: 23.0%
- USDJPY: 17.7%
- GBPUSD (also called *cable*): 9.2%

The U.S. currency was involved in 87.6% of transactions, followed by the euro (31.3%), the yen (21.6%), and sterling (12.8%) . Volume percentages for all individual currencies should add up to 200%, as each transaction involves two currencies.

Trading in the euro has grown considerably since the currency's creation in January 1999, and how long the foreign exchange market will remain dollar-centered is open to debate. Until recently, trading the euro versus a non-European currency ZZZ would have usually involved two trades: EURUSD and USDZZZ. The exception to this is EURJPY, which is an established traded currency pair in the interbank spot market.

The following theories explain the fluctuations in exchange rates in a floating exchange rate regime (In a fixed exchange rate regime, rates are decided by its government):

1. International parity conditions: Relative purchasing power parity, interest rate parity, Domestic Fisher effect, International Fisher effect. Though to some extent the above theories provide logical explanation for the fluctuations in exchange rates, yet these theories falter as they are based on challengeable assumptions [e.g., free flow of goods, services and capital] which seldom hold true in the real world.
2. Balance of payments model: This model, however, focuses largely on tradable goods and services, ignoring the increasing role of global capital flows. It failed to provide any explanation for the continuous appreciation of the US dollar during the 1980s and most of the 1990s, despite the soaring US current account deficit.
3. Asset market model: views currencies as an important asset class for constructing investment portfolios. Asset prices are influenced mostly by people's willingness to hold the existing quantities of assets, which in turn depends on their expectations on the future worth of these assets. The asset market model of exchange rate determination states that “the exchange rate between two currencies represents the price that just balances the relative supplies of, and demand for, assets denominated in those currencies.”

None of the models developed so far succeed to explain exchange rates and volatility in the longer time frames. For shorter time frames (less than a few days), algorithms can be devised to predict prices. It is understood from the above models that many macroeconomic factors affect the exchange rates and in the end

currency prices are a result of dual forces of demand and supply. The world's currency markets can be viewed as a huge melting pot: in a large and ever-changing mix of current events, supply and demand factors are constantly shifting, and the price of one currency in relation to another shifts accordingly. No other market encompasses (and distills) as much of what is going on in the world at any given time as foreign exchange.

Supply and demand for any given currency, and thus its value, are not influenced by any single element, but rather by several. These elements generally fall into three categories: economic factors, political conditions and market psychology.

These include: (a) economic policy, disseminated by government agencies and central banks, (b) economic conditions, generally revealed through economic reports, and other economic indicators.

- Economic policy comprises government fiscal policy (budget/spending practices) and monetary policy (the means by which a government's central bank influences the supply and "cost" of money, which is reflected by the level of interest rates).
- Government budget deficits or surpluses: The market usually reacts negatively to widening government budget deficits, and positively to narrowing budget deficits. The impact is reflected in the value of a country's currency.
- Balance of trade levels and trends: The trade flow between countries illustrates the demand for goods and services, which in turn indicates demand for a country's currency to conduct trade. Surpluses and deficits in trade of goods and services reflect the competitiveness of a nation's economy. For example, trade deficits may have a negative impact on a nation's currency.
- Inflation levels and trends: Typically a currency will lose value if there is a high level of inflation in the country or if inflation levels are perceived to be rising. This is because inflation erodes purchasing power, thus demand, for that particular currency. However, a currency may sometimes strengthen when inflation rises because of expectations that the central bank will raise short-term interest rates to combat rising inflation.
- Economic growth and health: Reports such as GDP, employment levels, retail sales, capacity utilization and others, detail the levels of a country's economic growth and health. Generally, the more healthy and robust a country's economy, the better its currency will perform, and the more demand for it there will be.
- Productivity of an economy: Increasing productivity in an economy should positively influence the value of its currency. Its effects are more prominent if the increase is in the traded sector.

Internal, regional, and international political conditions and events can have a profound effect on currency markets.

All exchange rates are susceptible to political instability and anticipations about the new ruling party. Political upheaval and instability can have a negative impact on a nation's economy. For example, destabilization of coalition governments in Pakistan and Thailand can negatively affect the value of their currencies. Similarly, in a country experiencing financial difficulties, the rise of a political faction that is perceived to be fiscally responsible can have the opposite effect. Also, events in one country in a region may spur positive/negative interest in a neighboring country and, in the process, affect its currency.

Market psychology

Market psychology and trader perceptions influence the foreign exchange market in a variety of ways:

- **Flights to quality:** Unsettling international events can lead to a "flight-to-quality", a type of capital flight whereby investors move their assets to a perceived "safe haven". There will be a greater demand, thus a higher price, for currencies perceived as stronger over their relatively weaker counterparts. The US dollar, Swiss franc and gold have been traditional safe havens during times of political or economic uncertainty.
- **Long-term trends:** Currency markets often move in visible long-term trends. Although currencies do not have an annual growing season like physical commodities, business cycles do make themselves felt. Cycle analysis looks at longer-term price trends that may rise from economic or political trends.
- **"Buy the rumor, sell the fact":** This market truism can apply to many currency situations. It is the tendency for the price of a currency to reflect the impact of a particular action before it occurs and, when the anticipated event comes to pass, react in exactly the opposite direction. This may also be referred to as a market being "oversold" or "overbought". To buy the rumor or sell the fact can also be an example of the cognitive bias known as anchoring, when investors focus too much on the relevance of outside events to currency prices.
- **Economic numbers:** While economic numbers can certainly reflect economic policy, some reports and numbers take on a talisman-like effect: the number itself becomes important to market psychology and may have an immediate impact on short-term market moves. "What to watch" can change over time. In recent years, for example, money supply, employment, trade balance figures and inflation numbers have all taken turns in the spotlight.
- **Technical trading considerations:** As in other markets, the accumulated price movements in a currency pair such as EUR/USD can form apparent patterns

that traders may attempt to use. Many traders study price charts in order to identify such patterns.

Financial instruments

A spot transaction is a two-day delivery transaction (except in the case of trades between the US dollar, Canadian dollar, Turkish lira, euro and Russian ruble, which settle the next business day), as opposed to the futures contracts, which are usually three months. This trade represents a “direct exchange” between two currencies, has the shortest time frame, involves cash rather than a contract, and interest is not included in the agreed-upon transaction. Spot trading is one of the most common types of Forex Trading. Often, a forex broker will charge a small fee to the client to roll-over the expiring transaction into a new identical transaction for a continuation of the trade. This roll-over fee is known as the "Swap" fee.

One way to deal with the foreign exchange risk is to engage in a forward transaction. In this transaction, money does not actually change hands until some agreed upon future date. A buyer and seller agree on an exchange rate for any date in the future, and the transaction occurs on that date, regardless of what the market rates are then. The duration of the trade can be one day, a few days, months or years. Usually the date is decided by both parties. Then the forward contract is negotiated and agreed upon by both parties.

Forex banks, ECNs, and prime brokers offer NDF contracts, which are derivatives that have no real deliver-ability. NDFs are popular for currencies with restrictions such as the Argentinian peso. In fact, a Forex hedger can only hedge such risks with NDFs, as currencies such as the Argentinian Peso cannot be traded on open markets like major currencies.

The most common type of forward transaction is the foreign exchange swap. In a swap, two parties exchange currencies for a certain length of time and agree to reverse the transaction at a later date. These are not standardized contracts and are not traded through an exchange. A deposit is often required in order to hold the position open until the transaction is completed.

Futures are standardized forward contracts and are usually traded on an exchange created for this purpose. The average contract length is roughly 3 months. Futures contracts are usually inclusive of any interest amounts.

Currency futures contracts are contracts specifying a standard volume of a particular currency to be exchanged on a specific settlement date. Thus the currency futures contracts are similar to forward contracts in terms of their obligation, but differ from forward contracts in the way they are traded. They are commonly used by MNCs to hedge their currency positions. In addition they are traded by speculators who hope to capitalize on their expectations of exchange rate movements.

A foreign exchange option (commonly shortened to just FX option) is a derivative where the owner has the right but not the obligation to exchange money denominated in one currency into another currency at a pre-agreed exchange rate on a specified date. The FX options market is the deepest, largest and most liquid market for options of any kind in the world.

Controversy about currency speculators and their effect on currency devaluations and national economies recurs regularly. Economists, such as Milton Friedman, have argued that speculators ultimately are a stabilizing influence on the market, and that **stabilizing speculation** performs the important function of providing a market for hedgers and transferring risk from those people who don't wish to bear it, to those who do. Other economists, such as Joseph Stiglitz, consider this argument to be based more on politics and a free market philosophy than on economics.

Large hedge funds and other well capitalized "position traders" are the main professional speculators. According to some economists, individual traders could act as "noise traders" and have a more destabilizing role than larger and better informed actors.

Currency speculation is considered a highly suspect activity in many countries. While investment in traditional financial instruments like bonds or stocks often is considered to contribute positively to economic growth by providing capital, currency speculation does not; according to this view, it is simply gambling that often interferes with economic policy. For example, in 1992, currency speculation forced the Swedish National Bank (the central bank of Sweden) to raise interest rates for a few days to 500% per annum, and later to devalue the krona. Mahathir Mohamad, one of the former Prime Ministers of Malaysia, is one well-known proponent of this view. He blamed the devaluation of the Malaysian ringgit in 1997 on George Soros and other speculators.

Gregory Millman reports on an opposing view, comparing speculators to "vigilantes" who simply help "enforce" international agreements and anticipate the effects of basic economic "laws" in order to profit.

In this view, countries may develop unsustainable economic bubbles or otherwise mishandle their national economies, and foreign exchange speculators made the inevitable collapse happen sooner. A relatively quick collapse might even be preferable to continued economic mishandling, followed by an eventual, larger, collapse. Mahathir Mohamad and other critics of speculation are viewed as trying to deflect the blame from themselves for having caused the unsustainable economic conditions.

Risk aversion is a kind of trading behavior exhibited by the foreign exchange market when a potentially adverse event happens which may affect market conditions. This behavior is caused when risk averse traders liquidate their positions in risky assets and shift the funds to less risky assets due to uncertainty.

In the context of the foreign exchange market, traders liquidate their positions in various currencies to take up positions in safe-haven currencies, such as the US dollar. Sometimes, the choice of a safe haven currency is more of a choice based on prevailing sentiments rather than one of economic statistics. An example would be the Financial Crisis of 2008. The value of equities across the world fell while the US dollar strengthened . This happened despite the strong focus of the crisis in the US.

Currency carry trade refers to the act of borrowing one currency that has a low interest rate in order to purchase another with a higher interest rate. A large difference in rates can be highly profitable for the trader, especially if high leverage is used. However, with all levered investments this is a double edged sword, and large exchange rate price fluctuations can suddenly swing trades into huge losses.

Foreign exchange aggregator

A foreign exchange aggregator or FX Aggregator is a class of systems used in Forex trading to aggregate the liquidity from several liquidity providers.

Aggregators usually provide two main functions; they allow FX traders to compare price from different liquidity venues such as banks-global market makers or ECNs like Currenex, FXall or Hotspot FX and to have a consolidated view of the market. They allow traders to trade with many participants using a single API or a single trading terminal. Some of the systems support order sweeping (an order is split into the chunks which are sent to the respective counterparties based on the price, time and other attributes of the quotes from these counterparties), other systems route the whole order to a single liquidity provider who is chosen by an order routing algorithm embedded into an aggregator.

FX Aggregator implementation is complex as the technology needs to be fast (Latencies in microseconds) and flexible. Some banks developed their own FX Aggregators and others bought existing products from technology vendors.

There are many aggregators offered in the market: smartTrade LiquidityFX, Thomson Reuters Dealing Aggregator, Liquid-X, Liquidity Pool, FlexTrade, BidFX, Quotix, Integral, Currenex, LMAX Exchange, MarketFactory, EBS Direct, DealHub, Seamless FX, Gold-i Matrix and others.

Foreign exchange derivative

A foreign exchange derivative is a financial derivative whose payoff depends on the foreign exchange rate(s) of two (or more) currencies. These instruments are commonly used for currency speculation and arbitrage or for hedging foreign exchange risk.

Foreign exchange transactions can be traced back to the fourteenth Century in the UK, but the coming into being and development of foreign exchange derivatives market was in the 1970s with the historical background and economic environment. Firstly, after the collapse of the Bretton Woods system, in 1976, IMF held a meeting in Jamaica and reached the Jamaica agreement. When floating exchange rate system replacing a fixed exchange rate system, many countries had gradually relaxed the control of interest rate and the risk of financial market increased. In order to reduce and avoid risks and achieve the purpose of hedging, modern financial derivatives came into being. Secondly, economic globalization promoted the globalization of financial activities and financial markets. After the collapse of the Bretton Woods system, a large number of capitals flew across the world. Countries generally relaxed restrictions on domestic and foreign financial institutions and foreign investors. Changes in macroeconomic factors led to the market risk and the demand for foreign exchange derivatives market increasing further, what promoted the development of the derivatives market. Under such circumstances, financial institutions continue to create new financial tools to meet the needs of traders for avoiding the risk. Therefore, a large number of foreign exchange derivatives was widely used, making the foreign exchange market expanded from the traditional transactions market to the derivatives market, and develop rapidly.

Margin trading, which means you could pay part of margin but make full transaction without the practically transferring of your principal. The end of contract mostly adopt the settlement for differences. At the same time, the buyers need not to present full payment only when the physical delivery gets performed on the maturity date. Therefore, the characters of trading financial derivatives include the lever effect. When margin decreases, the risk of trading will increase, as the lever effect will increase.

Foreign exchange derivatives can allow investors to engage in risk avoidance to keep value, but also can earn profit through speculation. This kind of specific duality makes derivatives more uncontrollable. Thus, foreign exchange derivative products can be risky while rewardable.(Chen Qi, 2009); in addition speculative transactions in the financial market are considered negatively and of potential damage to the real economy.

Foreign exchange option

In finance, a foreign exchange option (commonly shortened to just FX option or currency option) is a derivative financial instrument that gives the right but not the obligation to exchange money denominated in one currency into another currency at a pre-agreed exchange rate on a specified date.

The foreign exchange options market is the deepest, largest and most liquid market for options of any kind. Most trading is over the counter (OTC) and is lightly regulated, but a fraction is traded on exchanges like the International Securities Exchange, Philadelphia Stock Exchange, or the Chicago Mercantile Exchange for options on futures contracts. The global market for exchange-traded currency options was notionally valued by the Bank for International Settlements at \$158.3 trillion in 2005.

For example, a GBPUSD contract could give the owner the right to sell £1,000,000 and buy \$2,000,000 on December 31. In this case the pre-agreed exchange rate, or strike price, is 2.0000 USD per GBP (or GBP/USD 2.00 as it is typically quoted) and the notional amounts (notionals) are £1,000,000 and \$2,000,000.

This type of contract is both a call on dollars and a put on sterling, and is typically called a *GBPUSD put*, as it is a put on the *exchange rate*; although it could equally be called a *USDGBP call*.

If the rate is lower than 2.0000 on December 31 (say 1.9000), meaning that the dollar is stronger and the pound is weaker, then the option is exercised, allowing the owner to sell GBP at 2.0000 and immediately buy it back in the spot market at 1.9000, making a profit of $(2.0000 \text{ GBPUSD} - 1.9000 \text{ GBPUSD}) \times 1,000,000 \text{ GBP} = 100,000 \text{ USD}$ in the process. If instead they take the profit in GBP (by selling the USD on the spot market) this amounts to $100,000 / 1.9000 = 52,632 \text{ GBP}$.

Terms

- Call option – the right to buy an asset at a fixed date and price.
- Put option – the right to sell an asset at a fixed date and price.
- Foreign exchange option – the right to sell money in one currency and buy money in another currency at a fixed date and rate.
- Strike price – the asset price at which the investor can exercise an option.

- Spot price – the price of the asset at the time of the trade.
- Forward price – the price of the asset for delivery at a future time.
- Notional – the amount of each currency that the option allows the investor to sell or buy.
- Ratio of notionals – the *strike*, not the current *spot* or *forward*.
- Numéraire – the currency in which an asset is valued.
- Non-linear payoff – the payoff for a straightforward FX option is linear in the underlying currency, denominating the payout in a given numéraire.
- In the money – for a put option, this is when the current price is less than the strike price, and would thus generate a profit were it exercised; for a call option the situation is inverted.

The difference between FX options and traditional options is that in the latter case the trade is to give an amount of money and receive the right to buy or sell a commodity, stock or other non-money asset. In FX options, the asset in question is also money, denominated in another currency.

For example, a call option on oil allows the investor to buy oil at a given price and date. The investor on the other side of the trade is in effect selling a put option on the currency.

To eliminate residual risk, match the *foreign* currency notionals, not the local currency notionals, else the foreign currencies received and delivered don't offset.

Corporations primarily use FX options to hedge *uncertain* future cash flows in a foreign currency. The general rule is to hedge *certain* foreign currency cash flows with *forwards*, and *uncertain* foreign cash flows with *options*.

Suppose a United Kingdom manufacturing firm expects to be paid US\$100,000 for a piece of engineering equipment to be delivered in 90 days. If the GBP strengthens against the US\$ over the next 90 days the UK firm loses money, as it will receive less GBP after converting the US\$100,000 into GBP. However, if the GBP weakens against the US\$, then the UK firm receives more GBP. This uncertainty exposes the firm to FX risk. Assuming that the cash flow is certain, the firm can enter into a forward contract to deliver the US\$100,000 in 90 days time, in exchange for GBP at the current forward rate. This forward contract is free, and, presuming the expected cash arrives, exactly matches the firm's exposure, perfectly hedging their FX risk.

If the cash flow is uncertain, a forward FX contract exposes the firm to FX risk in the *opposite* direction, in the case that the expected USD cash is *not* received, typically making an option a better choice.

Using options, the UK firm can purchase a GBP call/USD put option (the right to sell part or all of their expected income for pounds sterling at a predetermined rate), which:

- protects the GBP value that the firm expects in 90 days' time (presuming the cash is received)
- costs at most the option premium (unlike a forward, which can have unlimited losses)
- yields a profit if the expected cash is not received but FX rates move in its favor

A wide range of techniques are in use for calculating the options risk exposure, or Greeks (as for example the Vanna-Volga method). Although the option prices produced by every model agree (with Garman–Kohlhagen), risk numbers can vary significantly depending on the assumptions used for the properties of spot price movements, volatility surface and interest rate curves.

After Garman–Kohlhagen, the most common models are SABR and local volatility although when agreeing risk numbers with a counterparty (e.g. for exchanging delta, or calculating the strike on a 25 delta option) Garman–Kohlhagen is always used.

Foreign exchange risk

Foreign exchange risk (also known as FX risk, exchange rate risk or currency risk) is a financial risk that exists when a financial transaction is denominated in a currency other than that of the base currency of the company. Foreign exchange risk also exists when the foreign subsidiary of a firm maintains financial statements in a currency other than the reporting currency of the consolidated entity. The risk is that there may be an adverse movement in the exchange rate of the denomination currency in relation to the base currency before the date when the transaction is completed. Investors and businesses exporting or importing goods and services or making foreign investments have an exchange rate risk which can have severe financial consequences; but steps can be taken to manage (i.e. reduce) the risk.

A firm has *transaction risk* whenever it has contractual cash flows (receivables and payables) whose values are subject to unanticipated changes in exchange rates due to a contract being denominated in a foreign currency. To realize the domestic value of its foreign-denominated cash flows, the firm must exchange foreign currency for domestic currency. As firms negotiate contracts with set prices and delivery dates in the face of a volatile foreign exchange market with exchange rates constantly fluctuating, the firms face a risk of changes in the exchange rate between the foreign and domestic currency. It refers to the risk associated with the change in the exchange rate between the time an enterprise initiates a transaction and settles it.

Applying public accounting rules causes firms with transnational risks to be impacted by a process known as "re-measurement". The current value of contractual cash flows are remeasured at each balance sheet.

A firm has *economic risk* (also known as *forecast risk*) to the degree that its market value is influenced by unexpected exchange rate fluctuations. Such exchange rate adjustments can severely affect the firm's market share position with regards to its competitors, the firm's future cash flows, and ultimately the firm's value. Economic risk can affect the present value of future cash flows. Any transaction that exposes the firm to foreign exchange risk also exposes the firm economically, but economic risks can be caused by other business activities and investments which may not be mere international transactions, such as future cash flows from fixed assets. A shift in exchange rates that influences the demand for a good in some country would also be an economic risk for a firm that sells that good.

A firm's *translation risk* is the extent to which its financial reporting is affected by exchange rate movements. As all firms generally must prepare consolidated financial statements for reporting purposes, the consolidation process for multinationals entails translating foreign assets and liabilities or the financial statements of foreign subsidiaries from foreign to domestic currency. While translation risk may not affect a firm's cash flows, it could have a significant impact on a firm's reported earnings and therefore its stock price.

A firm has *contingent risk* when bidding for foreign projects or negotiating other contracts or foreign direct investments. Such a risk arises from the potential of a firm to suddenly face a transnational or economic foreign exchange risk, contingent on the outcome of some contract or negotiation. For example, a firm could be waiting for a project bid to be accepted by a foreign business or government that if accepted would result in an immediate receivable. While waiting, the firm faces a contingent risk from the uncertainty as to whether or not that receivable will happen.

If foreign exchanges market are efficient such that purchasing power parity, interest rate parity, and the international Fisher effect hold true, a firm or investor needn't protect against foreign exchange risk due to an indifference toward international investment decisions. A deviation from one or more of the three international parity conditions generally needs to occur for an exposure to foreign exchange risk.

Financial risk is most commonly measured in terms of the variance or standard deviation of a variable such as percentage returns or rates of change. In foreign exchange, a relevant factor would be the rate of change of the spot exchange rate between currencies. Variance represents exchange rate risk by the spread of exchange rates, whereas standard deviation represents exchange rate risk by the amount exchange rates deviate, on average, from the mean exchange rate in a probability distribution. A higher standard deviation would signal a greater currency risk. Economists have criticized the accuracy of standard deviation as a risk indicator for its uniform treatment of deviations, be they positive or negative, and for automatically squaring deviation values. Alternatives such as average absolute deviation and semivariance have been advanced for measuring financial risk.

Practitioners have advanced and regulators have accepted a financial risk management technique called value at risk (VaR), which examines the tail end of a distribution of returns for changes in exchange rates to highlight the outcomes with the worst returns. Banks in Europe have been authorized by the Bank for International Settlements to employ VaR models of their own design in establishing capital requirements for given levels of market risk. Using the VaR model helps risk managers determine the amount

that could be lost on an investment portfolio over a certain period of time with a given probability of changes in exchange rate .

Firms with exposure to foreign exchange risk may use a number of foreign exchange hedging strategies to reduce the exchange rate risk. Transaction exposure can be reduced either with the use of the money markets, foreign exchange derivatives such as forward contracts, futures contracts, options, and swaps, or with operational techniques such as currency invoicing, leading and lagging of receipts and payments, and exposure netting.

Firms may adopt alternative strategies to financial hedging for managing their economic or operating exposure, by carefully selecting production sites with a mind for lowering costs, using a policy of flexible sourcing in its supply chain management, diversifying its export market across a greater number of countries, or by implementing strong research and development activities and differentiating its products in pursuit of greater inelasticity and less foreign exchange risk exposure.

Translation exposure is largely dependent on the accounting standards of the home country and the translation methods required by those standards. For example, the United States Federal Accounting Standards Board specifies when and where to use certain methods such as the temporal method and current rate method. Firms can manage translation exposure by performing a balance sheet hedge. Since translation exposure arises from discrepancies between net assets and net liabilities on a balance sheet solely from exchange rate differences. Following this logic, a firm could acquire an appropriate amount of exposed assets or liabilities to balance any outstanding discrepancy. Foreign exchange derivatives may also be used to hedge against translation exposure.

Many businesses were unconcerned with and did not manage foreign exchange risk under the Bretton Woods system of international monetary order. It wasn't until the switch to floating exchange rates following the collapse of the Bretton Woods system that firms became exposed to an increasing risk from exchange rate fluctuations and began trading an increasing volume of financial derivatives in an effort to hedge their exposure. The currency crises of the 1990s and early 2000s, such as the Mexican peso crisis, Asian currency crisis, 1998 Russian financial crisis, and the Argentine peso crisis, led to substantial losses from foreign exchange and led firms to pay closer attention to their foreign exchange risk.

Foreign exchange swap

In finance, a foreign exchange swap, forex swap, or FX swap is a simultaneous purchase and sale of identical amounts of one currency for another with two different value dates (normally spot to forward) and may use foreign exchange derivatives. An FX swap allows sums of a certain currency to be used to fund charges designated in another currency without acquiring foreign exchange risk. It permits companies that have funds in different currencies to manage them efficiently.

A foreign exchange swap has two legs - a spot transaction and a forward transaction - that are executed simultaneously for the same quantity, and therefore offset each other. Forward foreign exchange transactions occur if both companies have a currency the other needs. It prevents negative foreign exchange risk for either party. Foreign exchange spot transactions are similar to forward foreign exchange transactions in terms of how they are agreed upon; however, they are planned for a specific date in the very near future, usually within the same week.

It is also common to trade "forward-forward" where both transactions are for (different) forward dates.

The most common use of foreign exchange swaps is for institutions to fund their foreign exchange balances.

Once a foreign exchange transaction settles, the holder is left with a positive (or "long") position in one currency and a negative (or "short") position in another. In order to collect or pay any overnight interest due on these foreign balances, at the end of every day institutions will close out any foreign balances and re-institute them for the following day. To do this they typically use "tom-next" swaps, buying (or selling) a foreign amount settling tomorrow, and then doing the opposite, selling (or buying) it back settling the day after.

The interest collected or paid every night is referred to as the cost of carry. As currency traders know roughly how much holding a currency position will make or cost on a daily basis, specific trades are put on based on this; these are referred to as carry trades.

Companies may also use them to avoid foreign exchange risk.

Example:

A British Company may be long EUR from sales in Europe but operate primarily in Britain using GBP. However, they know that they need to pay their manufacturers in Europe in 1 month.

They could spot sell their EUR and buy GBP to cover their expenses in Britain, and then in one month spot buy EUR and sell GBP to pay their business partners in Europe.

However, this exposes them to FX risk. If Britain has financial trouble and the EUR/GBP exchange rate moves against them, they may have to spend a lot more GBP to get the same amount of EUR.

Therefore they create a 1 month swap, where they Sell EUR and Buy GBP on spot and simultaneously buy EUR and sell GBP on a 1 month (1M) forward. This significantly reduces their risk. The company knows they will be able to purchase EUR reliably while still being able to use currency for domestic transactions in the interim.

A foreign exchange swap should not be confused with a currency swap, which is a rarer long-term transaction governed by different rules.

Foreign exchange spot

A foreign exchange spot transaction, also known as FX spot, is an agreement between two parties to buy one currency against selling another currency at an agreed price for settlement on the spot date. The exchange rate at which the transaction is done is called the spot exchange rate. As of 2010, the average daily turnover of global FX spot transactions reached nearly 1.5 trillion USD, counting 37.4% of all foreign exchange transactions. FX spot transactions increased by 38% to 2.0 trillion USD from April 2010 to April 2013.

The standard settlement timeframe for foreign exchange spot transactions is T+2; i.e., two business days from the trade date. Notable exceptions are USD/CAD, USD/TRY, USD/PHP, USD/RUB, USD/KZT and USD/PKR currency pairs, which settle at T+1.

Execution methods

Common methods of executing a spot foreign exchange transaction include the following:

- *Direct* – Executed between two parties directly and not intermediated by a third party. For example, a transaction executed via direct telephone communication or direct electronic dealing systems such as Reuters Conversational Dealing
- *Electronic broking systems* – Executed via automated order matching system for foreign exchange dealers. Examples of such systems are EBS and Reuters Matching 2000/2
- *Electronic trading systems* – Executed via a single-bank proprietary platform or a multibank dealing system. These systems are generally geared towards customers. Examples of multibank systems include Integral, FXall, HotSpotFX, Currenex, LMAX Exchange, FX Connect, Prime Trade, Globalink, Seamless FX, and eSpeed
- *Voice broker* – Executed via telephone with a foreign exchange voice broker

Local currency

In economics, a local currency is a currency that can be spent in a particular geographical locality at participating organisations. A regional currency is a form of local currency encompassing a larger geographical area. A local currency acts as a complementary currency to a national currency, rather than replacing it, and aims to encourage spending within a local community, especially with locally owned businesses. The currency may not be backed by a national government or be legal tender. About 300 complementary currencies, including local currencies, are listed in the Complementary Currency Resource Center worldwide database.

Some definitions:

- Complementary currency - is used as a complement to a national currency, as a medium of exchange, which is usually not legal tender.
- Community currency - a complementary currency used by a group with a common bond, such as residents of a locality, association, or members of a business or online community.
- **Local currency** - a complementary currency used in a locality.
- **Regional currency** - a local currency where the locality is a larger region.
- **Auxiliary currency, microcurrency, Eco-Money** - less common synonyms for community or local currency. (see for example Douthwaite & Wagman 1999)
- Private currency - a currency issued by an individual, business or non-governmental organization. Complementary currencies are a type of private currency.
- Sectoral currency - a complementary currency used within one economic sector, such as education or health care.
- Alternative currency - generally, a synonym for complementary currency, referring to a currency designed to work in conjunction with the national currency; less often refers to a type of private currency which attempts to supplant or circumvent the national currency.

The Wörgl experiment illustrates some of the common characteristics and major benefits of local currencies.

1. Local currencies with negative interest rate or demurrage tend to circulate much more rapidly than national currencies. The same amount of currency in circulation is employed more times and results in far greater overall economic activity. It produces greater benefit per unit. The higher velocity of money is a result of the negative interest rate which encourages people to spend the money more quickly.
2. Local currencies enable the community to more fully utilize its existing productive resources, especially unemployed labor, which has a catalytic effect on the rest of the local economy. They are based on the premise that the community is not fully utilizing its productive capacities, because of a lack of local purchasing power. The alternative currency is utilized to increase demand, resulting in a greater exploitation of productive resources. So long as the local economy is functioning at less than full capacity, the introduction of local currency need not be inflationary, even when it results in a significant increase in total money supply and total economic activity.
3. Since local currencies are only accepted within the community, their usage encourages the purchase of locally produced and locally-available goods and services. Thus, for any level of economic activity, more of the benefit accrues to the local community and less drains out to other parts of the country or the world. For instance, construction work undertaken with local currencies employs local labor and utilizes as far as possible local materials. The enhanced local effect becomes an incentive for the local population to accept and utilize the scrips.
4. Some forms of complementary currency can promote fuller utilization of resources over a much wider geographic area and help bridge the barriers imposed by distance. The Fureai kippu system in Japan issues credits in exchange for assistance to senior citizens. Family members living far from their parents can earn credits by offering assistance to the elderly in their local community. The credits can then be transferred to their parents and redeemed by them for local assistance. Airline frequent flyer miles are a form of complementary currency that promotes customer-loyalty in exchange for free travel. The airlines offer most of the coupons for seats on less heavily sold flights where some seats normally go empty, thus providing a benefit to customers at relatively low cost to the airline.
5. While most of these currencies are restricted to a small geographic area or a country, through the Internet electronic forms of complementary currency can be used to stimulate transactions on a global basis. In China, Tencent's QQ coins are a virtual form of currency that has gained wide circulation. QQ coins can be bought for Renminbi and used to buy virtual products and services such as ringtones and on-line video game time. They can also be obtained through on-line exchange for goods and services at about twice the Renminbi price, by which additional 'money' is being directly created. Though virtual currencies are not 'local' in the tradition sense, they do

cater to the specific needs of a particular community, a virtual community. Once in circulation, they add to the total effective purchasing power of the on-line population as in the case of local currencies. The Chinese government has begun to tax the coins as they are exchanged from virtual currency to actual hard currency.

Local currencies and the Transition Towns movement in the UK have been criticized for failing to address the needs of the wider population, especially lower socio-economic groups. Such local currency initiatives have been more widely criticized as having limited success in stimulating spending in local economies, and as an unrealistic strategy to reduce carbon emissions.

Modern local currencies can be classified into the following distinct types:

1. Transition currency based on the local currencies used by the Transition Towns movement in the UK. They include Brixton Pound and Bristol Pound in the UK, BerkShares in the USA, and Salt Spring Dollars in Canada.

Transition currencies are payment voucher-based systems that are exchangeable with the national currency. Between 2002-2014 many experiments in local currency took this form. Such currencies aim to raise the resilience of local economies by encouraging re-localisation of buying and food production. The drive for this change has arisen from a range of community-based initiatives and social movements. The Transition Towns movement originating in the UK has utilised local currencies for re-localisation in the face of energy descent from peak oil and climate change. Other drives include movements against Clone town and Big-box trends.

2. Rewards currency based on the frequent flyer model. Consumer spends cash with participating businesses who issue rewards points in a local currency. These rewards points can be used to offset cash prices in future purchases. An example is Oakland Grown in Oakland, CA.

3. Mutual Credit currency based on the mutual credit system. This can be further subdivided into two:

- a. Time-based currency also known as Time Banks that use time as a measure of value. An example is Dane County Time Bank.

b. Trade exchanges and LETS (local exchange trading system) that use price as a measure of value. An example of local currency implemented as a trade exchange is Bay Bucks in the Bay Area of California, USA. LETS were originally started in Vancouver, Canada, there are presently more than 30 LETS systems operating in Canada and over 400 in the United Kingdom. Australia, France, New Zealand, and Switzerland have similar systems.

Local exchange trading system

A local exchange trading system (also local employment and trading system or local energy transfer system; abbreviated LETS) is a locally initiated, democratically organised, not-for-profit community enterprise that provides a community information service and records transactions of members exchanging goods and services by using locally created currency. LETS allow people to negotiate the value of their own hours or services.

Michael Linton originated the term "local exchange trading system" in 1983 and for a time ran the Comox Valley LETS systems in Courtenay, British Columbia. The system he designed was intended as an adjunct to the national currency, rather than a replacement for it.

LETS networks facilitate exchange between members by providing a directory of offers (and wants) and by allowing a line of interest-free credit to each. Members' IOUs are logged in a centralised accounting system which publishes a directory and balances visible to all members. In case of a default, the loss of value or units is absorbed equally by all members, which makes it a mutual credit exchange. For instance, a member may earn credit by doing childcare for one person and spend it later on carpentry with another person in the same network, or they may spend first and earn later.

The time-based currency mentioned in United Nations Millennium Declaration C6 to Governments was a UNILETS United Nations International & Local Employment-Trading System to restructure the global financial architecture.

Many people have difficulty adjusting to this different kind of money system. A conventional national currency which yields interest to savers and costs interest to borrowers incentivises different behaviours to mutual credit which has no commodity value and no interest.

Most groups range from 50–150 members with a small core who use the system as a way of life. After flourishing in the 1990s, the LETS movement is mostly now populated by the same aging people. Interest in local currency has moved on to other designs such as time-based currency and dollar-backed local voucher schemes. In many countries apart from Canada, USA and UK, the distinction between LETS

and timebanking is much less clear, as most LETS now use time as their unit of account.

On the whole, the movement has been slow to adapt to the internet and to the possibility of networking together. Reluctance to engage with technology, a belief in decentralisation/localisation and lack of funds all contributed to this. Currently, apart from flailing national organisations, there are two LETS networks based on free software: Community Exchange Systems, and Community Forge .

LETS are generally considered to have the following five fundamental criteria:

- Cost of service: from the community for the community
- Consent: there is no compulsion to trade
- Disclosure: information about balances is available to all members
- Equivalence to the national currency
- No interest

Of these criteria, "equivalence" is the most controversial. According to a 1996 survey by LetsLink UK, only 13% of LETS networks actually practice equivalence, with most groups establishing alternate systems of valuation "in order to divorce [themselves] entirely from the mainstream economy." Michael Linton has stated that such systems are "personal money" networks rather than LETS.

The first LETS required nothing more than a telephone, an answering machine and a notebook. Since then there have been several attempts to improve the process with software, printed notes, and other familiar aspects of traditional currencies.

1. Local people set up an organization to trade between themselves, often paying a small membership fee to cover administration costs
2. Members maintain a directory of offers and wants to help facilitate trades
3. Upon trading, members may 'pay' each other with printed notes, log the transaction in log books or online, or write cheques which are later cleared by the system accountant.
4. Members whose balances exceed specified limits (positive or negative) are obliged to move their balance back towards zero by spending or earning.

LETS is a full-fledged monetary or exchange system, unlike direct barter. LETS members are able to earn credits from any member and spend them with anyone else on the scheme. Since the details are worked out by the users, there is much variation between schemes.

LETS is not a scheme for avoiding the payment of taxation, and generally groups encourage all members to personally undertake their liabilities to the state for all taxation, including income tax and goods and services tax. In a number of countries, various government taxation authorities have examined LETS along with other forms of counter trade, and made rulings concerning their use. Generally for personal arrangements, social arrangements, hobbies or pastimes, there are no taxation implications. This generally covers the vast majority of LETS transactions. Taxation liabilities accrue when a tradesperson or professional person provides his or her professional services in payment for LETS units, or a registered or incorporated business sells part of its product for LETS units. In such cases, the businesses are generally encouraged to sell the service or product partly for LETS units and partly in the national currency, to allow the payment of all required taxation. This does imply, however, that in situations where national-currency expenditures would be tax-deductible, LETS must be as well.

In a number of countries, LETS systems have been encouraged as a social security initiative. For example, in Australia, Peter Baldwin, a former Minister of Social Security in the Keating government, encouraged LETS systems as a way of letting welfare recipients borrow against their welfare entitlement for urgent personal needs or to establish themselves in business.

Since its commencement over 20 years ago, LETS systems have been highly innovative in adapting to the needs of their local communities in all kinds of ways. For example, in Australia, people have built houses using LETS in place of a bank mortgage, freeing the owner from onerous interest payments.

LETS can help revitalise and build community by allowing a wider cross-section of the community—individuals, small businesses, local services and voluntary groups—to save money and resources in cooperation with others and extend their purchasing power. Other benefits may include social contact, health care, tuition and training, support for local enterprise and new businesses. One goal of this approach is to stimulate the economies of economically depressed towns that have goods and services, but little official currency: the LETS scheme does not require outside sources of income as stimulus.

Local exchange trading systems now exist in many countries. Currency exchange between countries is done automatically through the CES (Community Exchange Systems) if LETS members use the CES for their recorded transaction. On the CES such trading exchanges between countries are known as 'remote' trading.

Australia, in 1989 allocated \$50,000 for the development of LETSsystems, including the running of state conferences, the production of software, a LETSsystems Training Pack, and assistance to Michael Linton to visit Western Australia. By 1995 there were 250 LETSsystems in Australia, with Western Australia having 43 separate systems serving a population of 2.3 million (although actual participation is by only a tiny fraction of that population) making it then the region with the highest LETS coverage in the world. South Australia also pioneered an "InterLETS" allowing members of one system to trade with members of other systems.

From around 2007, many Australian LETS groups started trading online using the Community Exchange System. The Community Exchange System allows new members to sign up directly, list offers and wants, and enter trades without assistance from the administrator.

By 2011 Australia had become the most active country on the Community Exchange System, prompting Tim Jenkin and Annette Loudon to set up the Australian Community Exchange System .

Several Canadian cities have LETS groups, including Kitchener-Waterloo, Niagara, and Peterborough in Ontario; Halifax, Nova Scotia; and St. John's, Newfoundland

Ithaca, New York has been running its Ithaca Hours program since 1991.

Ecuador had 140 Ecosimias-Groups (in 2000).

In Venezuela there are around a dozen LETS (as of 2011), with support from the national government.

French speaking Europe has a coherent SEL (*Système d'Échange Local*, local exchange system) network.

In German speaking Europe there are lots of local "Tauschring", or "Tauschkreis" (exchange circles) networks which share all sorts of services. The Tauschring network in Germany provides software for most schemes in the German-speaking world, and CES now has over 250 participating associations, able to trade between each other with a process sometimes called intertrading.

In Hungary the term used is "Community Service System" (KÖR). One group from the capital city is Talentum Kör (Gold Talent Group), a British Council-supported project.

LETS schemes have been proposed as a possible way to alleviate some of the human costs of the euro crisis in Greece, where high foreign debt repayments have resulted in rapid deflation of the economy. LETS schemes, it is proposed, could reinflate the internal Greek economy, allowing internal trade to be maintained even if internationally traded currency reserves are being drained for debt repayment. This theory is beginning to be tested in the development of new LETS schemes in Greek cities such as Volos.

In the Czech Republic, multiple LETS are present. Rozlet'se, operating in the region of city of Brno sharing the same Cyclos3 server with other smaller groups in the regions of Jeseník, Ostrava and Beskydy, Pralets for the capital of Prague, Bud'Sob for the České Budějovice region etc.

The Netherlands has spawned a number of innovative concepts based on the LETS formula, some of which try to lower participation barriers by completely moving their exchange platforms online, like NOPPES.

In Switzerland an adaption of LETS, the Talent was established and quite successfully launched in 1992. This Talent spread out in Europe and was father of many other Talent-Groups in other countries, as mentioned above. Like in Germany there are Tauschkreise mostly operating with Cyclos Software. Also an on-line exchange platform called Easyswap was developed recently.

The United Kingdom has many LETS systems, many loosely affiliated to LETSLINK UK and some operating under the CES system, e.g. North London LETS. In the UK Skillsbox operates an online community system similar to LETS, letting users trade their skills and time for credits which can be spent within the online community.

Norway has more LETS system, One of which is LETS NORGE. www.Lets.no

In Japan, the *Peanuts system* is a LETS system in Chiba, near Tokyo. Approximately ten percent of all payments made at local stores are in the community currency (2002). The LETS movement saw its peak around 2002–2003, but since then it has been declining slowly.

South Korea has some active LETS too, such as Hanbat LETS in Daejeon and Gwacheon Pumasi in Gwacheon.

In 2003 the Community Exchange System (CES) started operating an internet-based LETS in Cape Town, South Africa. This has grown into a global network of over 800 local exchange systems in more than seventy countries (2014), among them Australia,

Finland, New Zealand, Poland, South Africa, Spain, USA, UK, Vanuatu etc. Many of these are former LETS groups but others are time banks and hybrids.

Interbank foreign exchange market

The interbank market is the top-level foreign exchange market where banks exchange different currencies. The banks can either deal with one another directly, or through electronic brokering platforms. The Electronic Broking Services (EBS) and Thomson Reuters Dealing are the two competitors in the electronic brokering platform business and together connect over 1000 banks. The currencies of most developed countries have floating exchange rates. These currencies do not have fixed values but, rather, values that fluctuate relative to other currencies.

The interbank market is an important segment of the foreign exchange market. It is a wholesale market through which most currency transactions are channeled. It is mainly used for trading among bankers. The three main constituents of the interbank market are:

- the spot market
- the forward market
- SWIFT (Society for World-Wide Interbank Financial Telecommunications)

The interbank market is unregulated and decentralized. There is no specific location or exchange where these currency transactions take place. However, foreign currency options are regulated in a number of countries and trade on a number of different derivatives exchanges. Central bank in many countries publish closing spot prices on a daily basis.

Unlike the stock market, the foreign currency exchange market (Forex) does not have a physical central exchange like the NYSE. Without a central exchange, currency exchange rates are made, or set, by market makers. Banks constantly quote a bid and ask price based on anticipated currency movements taking place and thereby make the market. Major banks handle very large forex transactions often in billions of units. These transactions cause the primary movement of currency prices in the short term.

Other factors contribute to currency exchange rates and these include forex transactions made by smaller banks, hedge funds, companies, forex brokers and traders. Companies are involved in forex transaction due to their need to pay for

products and services supplied from other countries which use a different currency. Forex traders on the other hand use forex transaction, of a much smaller volume with comparison to banks, to benefit from anticipated currency movements by buying cheap and selling at a higher price or vice versa. This is done through forex brokers who act as a mediator between a pool of traders and also between themselves and banks.

Central banks also play a role in setting currency exchange rates by altering interest rates. By increasing interest rates they stimulate traders to buy their currency as it provides a high return on investment and this drives the value of the corresponding central bank's currency higher with comparison to other currencies.

Forward exchange rate

The forward exchange rate (also referred to as forward rate or forward price) is the exchange rate at which a bank agrees to exchange one currency for another at a future date when it enters into a forward contract with an investor. Multinational corporations, banks, and other financial institutions enter into forward contracts to take advantage of the forward rate for hedging purposes. The forward exchange rate is determined by a parity relationship among the spot exchange rate and differences in interest rates between two countries, which reflects an economic equilibrium in the foreign exchange market under which arbitrage opportunities are eliminated. When in equilibrium, and when interest rates vary across two countries, the parity condition implies that the forward rate includes a premium or discount reflecting the interest rate differential. Forward exchange rates have important theoretical implications for forecasting future spot exchange rates. Financial economists have put forth a hypothesis that the forward rate accurately predicts the future spot rate, for which empirical evidence is mixed.

The forward exchange rate is the rate at which a commercial bank is willing to commit to exchange one currency for another at some specified future date. The forward exchange rate is a type of forward price. It is the exchange rate negotiated today between a bank and a client upon entering into a forward contract agreeing to buy or sell some amount of foreign currency in the future. Multinational corporations and financial institutions often use the forward market to hedge future payables or receivables denominated in a foreign currency against foreign exchange risk by using a forward contract to lock in a forward exchange rate. Hedging with forward contracts is typically used for larger transactions, while futures contracts are used for smaller transactions. This is due to the customization afforded to banks by forward contracts traded over-the-counter, versus the standardization of futures contracts which are traded on an exchange. Banks typically quote forward rates for major currencies in maturities of one, three, six, nine, or twelve months, however in some cases quotations for greater maturities are available up to five or ten years.

Covered interest rate parity is a no-arbitrage condition in foreign exchange markets which depends on the availability of the forward market. It can be rearranged to give the forward exchange rate as a function of the other variables. The forward exchange

rate depends on three known variables: the spot exchange rate, the domestic interest rate, and the foreign interest rate. This effectively means that the forward rate is the price of a forward contract, which derives its value from the pricing of spot contracts and the addition of information on available interest rates.

The following equation represents covered interest rate parity, a condition under which investors eliminate exposure to foreign exchange risk (unanticipated changes in exchange rates) with the use of a forward contract – the exchange rate risk is effectively *covered*. Under this condition, a domestic investor would earn equal returns from investing in domestic assets or converting currency at the spot exchange rate, investing in foreign currency assets in a country with a different interest rate, and exchanging the foreign currency for domestic currency at the negotiated forward exchange rate. Investors will be indifferent to the interest rates on deposits in these countries due to the equilibrium resulting from the forward exchange rate. The condition allows for no arbitrage opportunities because the return on domestic deposits, $1+i_d$, is equal to the return on foreign deposits, $[S/F](1+i_f)$. If these two returns weren't equalized by the use of a forward contract, there would be a potential arbitrage opportunity in which, for example, an investor could borrow currency in the country with the lower interest rate, convert to the foreign currency at today's spot exchange rate, and invest in the foreign country with the higher interest rate.

The equilibrium that results from the relationship between forward and spot exchange rates within the context of covered interest rate parity is responsible for eliminating or correcting for market inefficiencies that would create potential for arbitrage profits. As such, arbitrage opportunities are fleeting. In order for this equilibrium to hold under differences in interest rates between two countries, the forward exchange rate must generally differ from the spot exchange rate, such that a no-arbitrage condition is sustained. Therefore, the forward rate is said to contain a premium or discount, reflecting the interest rate differential between two countries. The following equations demonstrate how the forward premium or discount is calculated.

Foreign exchange hedge

A foreign exchange hedge (also called a FOREX hedge) is a method used by companies to eliminate or "hedge" their foreign exchange risk resulting from transactions in foreign currencies. This is done using either the cash flow hedge or the fair value method. The accounting rules for this are addressed by both the International Financial Reporting Standards (IFRS) and by the US Generally Accepted Accounting Principles (US GAAP) as well as other national accounting standards.

A foreign exchange hedge transfers the foreign exchange risk from the trading or investing company to a business that carries the risk, such as a bank. There is cost to the company for setting up a hedge. By setting up a hedge, the company also forgoes any profit if the movement in the exchange rate would be favourable to it.

When companies conduct business across borders, they must deal in foreign currencies. Companies must exchange foreign currencies for home currencies when dealing with receivables, and vice versa for payables. This is done at the current exchange rate between the two countries. Foreign exchange risk is the risk that the exchange rate will change unfavorably before payment is made or received in the currency. For example, if a United States company doing business in Japan is compensated in yen, that company has risk associated with fluctuations in the value of the yen versus the United States dollar.

A hedge is a type of derivative, or a financial instrument, that derives its value from an underlying asset. Hedging is a way for a company to minimize or eliminate foreign exchange risk. Two common hedges are forward contracts and options.

A forward contract will lock in an exchange rate today at which the currency transaction will occur at the future date.

An option sets an exchange rate at which the company may choose to exchange currencies. If the current exchange rate is more favorable, then the company will not exercise this option.

The main difference between the hedge methods is who derives the benefit of a favourable movement in the exchange rate. With a forward contract the other party

derives the benefit, while with an option the company retains the benefit by choosing not to exercise the option if the exchange rate moves in its favour.

Under IFRS

Guidelines for accounting for financial derivatives are given under IFRS 7. Under this standard, “an entity shall group financial instruments into classes that are appropriate to the nature of the information disclosed and that take into account the characteristics of those financial instruments. An entity shall provide sufficient information to permit reconciliation to the line items presented in the balance sheet”. Derivatives should be grouped together on the balance sheet and valuation information should be disclosed in the footnotes. This seems fairly straightforward, but IASB has issued two standards to help further explain this procedure.

The International Accounting Standards IAS 32 and 39 help to give further direction for the proper accounting of derivative financial instruments. IAS 32 defines a “financial instrument” as “any contract that gives rise to a financial asset of one entity and a financial liability or equity instrument of another entity”. Therefore, a forward contract or option would create a financial asset for one entity and a financial liability for another. The entity required to pay the contract holds a liability, while the entity receiving the contract payment holds an asset. These would be recorded under the appropriate headings on the balance sheet of the respective companies. IAS 39 gives further instruction, stating that the financial derivatives be recorded at fair value on the balance sheet. IAS 39 defines two major types of hedges. The first is a cash flow hedge, defined as: “a hedge of the exposure to variability in cash flows that (i) is attributable to a particular risk associated with a recognized asset or liability or a highly probable forecast transaction, and (ii) could affect profit or loss”. In other words, a cash flow hedge is designed to eliminate the risk associated with cash transactions that can affect the amounts recorded in net income.

Below is an example of a cash flow hedge for a company purchasing Inventory items in year 1 and making the payment for them in year 2, after the exchange rate has changed.

Date	Spot Rate	US \$ value	Change	Fwd. Rate	US \$ value	FV of contract	Change
12/1/Y1	\$1.00	\$20,000.00	\$0.00	\$1.04	\$20,800.00	\$0.00	\$0.00
12/31/Y1	\$1.05	\$21,000.00	\$1,000.00	\$1.10	\$22,000.00	(\$1,176.36)	(\$1,176.36)
3/2/Y2	\$1.12	\$22,400.00	\$1,400.00	\$1.12	\$22,400.00	(\$1,600.00)	(\$423.64)

The US Generally Accepted Accounting Principles also include instruction on accounting for derivatives. For the most part, the rules are similar to those given under IFRS. The standards that include these guidelines are SFAS 133 and 138. SFAS 133, written in 1998, stated that a “recognized asset or liability that may give rise to a foreign currency transaction gain or loss under Statement 52 (such as a foreign-currency-denominated receivable or payable) not be the hedged item in a foreign currency fair value or cash flow hedge”. Based on the language used in the statement, this was done because the FASB felt that the assets and liabilities listed on a company’s books should reflect their historic cost value, rather than being adjusted for fair value. The use of a hedge would cause them to be revalued as such. Remember that the value of the hedge is derived from the value of the underlying asset. The amount recorded at payment or reception would differ from the value of the derivative recorded under SFAS 133. As illustrated above in the example, this difference between the hedge value and the asset or liability value can be effectively accounted for by using either a cash flow or a fair value hedge. Thus, two years later FASB issued SFAS 138 which amended SFAS 133 and allowed both cash flow and fair value hedges for foreign exchanges. Citing the reasons given previously, SFAS 138 required the recording of derivative assets at fair value based on the prevailing spot rate.

Since 2004, the Bank of Canada has carried out a qualitative annual survey to assess the degree of activity in Canadian foreign exchange (FX) hedging. The survey participants consist of banks that are active in Canadian FX markets, including the eleven members of the Canadian Foreign Exchange Committee (CFEC). The main findings for the 2013 survey were:

- Banks have increased their attention on regulatory issues.
- Volatility was the main reason for hedging.
- Institutional customer volume accounted for the majority of hedging activity.
- There was high marginal use of derivatives in hedging.
- Credit has remained important.

Basis swap

A basis swap is an interest rate swap which involves the exchange of two floating rate financial instruments. A basis swap functions as a floating-floating interest rate swap under which the floating rate payments are referenced to different bases.

Usage of basis swaps for hedging

Basis risk occurs for positions that have at least one paying and one receiving stream of cash flows that are driven by different factors and the correlation between those factors is less than one. Entering into a Basis Swap may offset the effect of gains or losses resulting from changes in the basis, thus reducing basis risk.

1. against exposure to currency fluctuations (for example, 1 mo USD LIBOR for 1 mo GBP LIBOR)
2. against one index in the favor of another (for example, 1 mo USD T-bill for 1 mo USD LIBOR)
3. different points on a yield curve (for example, 1 mo USD LIBOR for 6 mo USD LIBOR)

Basis swaps in energy commodities

In energy markets, a basis swap is a swap on the price differential for a product and a major index product (e.g. Brent Crude or Henry Hub gas).

Binary option

A binary option is a financial option in which the payoff is either some fixed monetary amount or nothing at all. The two main types of binary options are the cash-or-nothing binary option and the asset-or-nothing binary option. The former pays some fixed amount of cash if the option expires in-the-money while the latter pays the value of the underlying security. They are also called all-or-nothing options, digital options (more common in forex/interest rate markets), and fixed return options (FROs) .

While binary options may be used in theoretical asset pricing, they are prone to fraud in their applications and hence banned by regulators in many jurisdictions as a form of gambling. Many binary option outlets have been exposed as fraudulent. The U.S. FBI is investigating binary option scams throughout the world, and the Israeli police has tied the industry to criminal syndicates. The FBI estimates that the scammers steal \$10 billion annually worldwide. The use of the names of famous and respectable people such as Richard Branson to encourage people to buy fake "investments" is frequent and increasing. Articles published in the *Times of Israel* newspaper explain the fraud in detail, using the experience of former insiders such as a job-seeker recruited by a fake binary options broker, who was told to "leave [his] conscience at the door". Following an investigation by the *Times of Israel*, Israel's cabinet approved a ban on sale of binary options in June 2017, and a law banning the products was approved by the Knesset in October 2017.

On January 30, 2018, Facebook banned advertisements for binary options trading as well as for cryptocurrencies and initial coin offerings (ICOs).

Binary options "are based on a simple 'yes' or 'no' proposition: Will an underlying asset be above a certain price at a certain time?" Trades place wagers as to whether that will or will not happen. If a customer believes the price of a commodity or currency will be above a certain price at a set time, he buys the binary option. If he believes it will be below that price, he sells the option. The price of a binary is always under \$100.

Investopedia described the binary options trading process in the U.S. thus:

[A] binary may be trading at \$42.50 (bid) and \$44.50 (offer) at 1 p.m. If you buy the binary option right then you will pay \$44.50, if you decide to sell right then you'll sell at \$42.50.

Let's assume you decide to buy at \$44.50. If at 1:30 p.m. the price of gold is above \$1,250, your option expires and it becomes worth \$100. You make a profit of $\$100 - \$44.50 = \$55.50$ (less fees). This is called being "in the money."

But if the price of gold is below \$1,250 at 1:30 p.m., the option expires at \$0. Therefore you lose the \$44.50 invested. This is called being "out of the money."

The bid and offer fluctuate until the option expires. You can close your position at any time before expiry to lock in a profit or a reduce a loss (compared to letting it expire out of the money).

Every option settles at \$100 or \$0, \$100 if the bet is correct, 0 if it is not.

On non-regulated platforms, client money is not necessarily kept in a trust account, as required by government financial regulation, and transactions are not monitored by third parties in order to ensure fair play.

Binary options are often considered a form of gambling rather than investment because of their negative cumulative payout (the brokers have an edge over the investor) and because they are advertised as requiring little or no knowledge of the markets. Gordon Pape, writing in *Forbes.com* in 2010, called binary options websites "gambling sites, pure and simple", and said "this sort of thing can quickly become addictive... no one, no matter how knowledgeable, can consistently predict what a stock or commodity will do within a short time frame".

Pape observed that binary options are poor from a gambling standpoint as well because of the excessive "house edge". One online binary options site paid \$71 for each successful \$100 trade. "If you lose, you get back \$15. Let's say you make 1,000 "trades" and win 545 of them. Your profit is \$38,695. But your 455 losses will cost you \$38,675. In other words, you must win 54.5% of the time just to break even".

The U.S. Commodity Futures Trading Commission warns that "some binary options Internet-based trading platforms may overstate the average return on investment by advertising a higher average return on investment than a customer should expect given the payout structure."

Many binary option "brokers" have been exposed as fraudulent operations. In those cases, there is no real brokerage; the customer is betting against the broker, who is

acting as a bucket shop. Manipulation of price data to cause customers to lose is common. Withdrawals are regularly stalled or refused by such operations; if a client has good reason to expect a payment, the operator will simply stop taking their phone calls. Though binary options sometimes trade on regulated exchange, they are generally unregulated, trading on the Internet, and prone to fraud. The U.S. Securities and Exchange Commission (SEC) and Commodity Futures Trading Commission (CFTC) have issued a joint warning to American investors regarding unregulated binary options, and have forced a major operator, Banc de Binary, to cease operations in the United States and pay back all customer losses.

In Israel, where a high concentration of such firms can be found, binary options trading was prohibited for Israeli customers in March 2016 on the grounds that it is a form of gambling and not a legitimate investment technique. On June 18, 2017, a ban on marketing binary options to customers outside of Israel was passed by the cabinet. It was approved by the Knesset in October, despite strong opposition from the binary options industry.

The Australian Securities and Investments Commission (ASIC) warned Australian investors on 13 February 2015 against Opteck, an unlicensed binary option provider. The ASIC later began a focused effort to control unlicensed derivative providers, including "review" websites, broker affiliates, and managed service providers related to binary option products.

In August 2016, Belgium's Financial Services and Markets Authority banned binary options schemes, based on concerns about widespread fraud.

No firms are registered in Canada to offer or sell binary options, so no binary options trading is currently allowed. Provincial regulators have proposed a complete ban on all binary options trading include a ban on online advertising for binary options trading sites. A complete ban on binary options trading for options having an expiration less than 30 days was announced on September 28, 2017.

On May 3, 2012, the Cyprus Securities and Exchange Commission (CySEC) announced a policy change regarding the classification of binary options as financial instruments. The effect is that binary options platforms operating in Cyprus, where many of the platforms are now based, would have to be CySEC regulated within six months of the date of the announcement. CySEC was the first EU MiFID-member regulator to treat binary options as financial instruments.

In 2013, CySEC prevailed over the disreputable binary options brokers and communicated intensively with traders in order to prevent the risks of using unregulated financial services. On September 19, 2013, CySEC sent out a press

release warning investors against binary options broker TraderXP, who was not and had never been licensed by CySEC. On October 18, 2013, CySEC released an investor warning about binary options broker NRGbinary and its parent company NRG Capital (CY) Ltd., stating that NRGbinary was not and had never been licensed by CySEC.

CySEC also temporarily suspended the license of the Cedar Finance on December 19, 2013, because the potential violations referenced appeared to seriously endanger the interests of the company's customers and the proper functioning of capital markets, as described in the official issued press release. CySEC also issued a warning against binary option broker PlanetOption at the end of the year and another warning against binary option broker LBinary on January 10, 2014, pointing out that it was not regulated by the Commission and the Commission had not received any notification by any of its counterparts in other European countries to the effect of this firm being a regulated provider.

The Cyprus regulator imposed a penalty of €15,000 against ZoomTrader. OptionBravo and ChargeXP were also financially penalized. CySEC also indicated that it had voted to reject the ShortOption license application.

In 2015, CySEC repeatedly fined Banc De Binary for several violations including the solicitation of U.S. clients. In 2016, the regulator fined Banc De Binary Ltd once again for violation of its legislation. The broker has come to a settlement of €350,000.

In August 2016, France's *Sapin II* bill on transparency was announced by the Autorité des Marchés Financiers (AMF), seeking to outlaw all financial derivatives advertising. The AMF stated that it would ban the advertising of certain highly speculative and risky financial contracts to private individuals by electronic means. The document applies specifically to binary options, and to contracts for difference (CFDs), and financial contracts on currencies. The French regulator is determined to cooperate with the legal authorities to have illegal websites blocked. The law also prohibits all forms of sponsorship and partnership that results in direct or indirect advertising of the financial products it covers. This ban was seen by industry watchers as having an impact on sponsored sports such as European football clubs.

The Cyprus-based company 24Option was banned from trading in France by AMF earlier in 2016. They had sponsored a well-known Irish mixed martial artist, Conor McGregor, who in turn promoted the company through social media.

Binary options trading

In March 2016 binary options trading within Israel was banned by the Israel Securities Authority, on the grounds that such trading is essentially gambling and not a form of investment management. The ban was extended to overseas clients as well in October 2017.

Responding to *The Times of Israel's* reporting, the Israeli Prime Minister's Office in October 2016 condemned the industry's "unscrupulous practices" and called for the entire industry to be outlawed worldwide.

Fraud

In 2016 *The Times of Israel* ran several articles on binary options fraud. "The wolves of Tel Aviv: Israel's vast, amoral binary options scam exposed" revealed that the industry is a scam. A second article describes in detail how a binary options salesman fleeced clients. "According to one ex-employee of a firm that employs over 1,000 people in a high-rise office building in Tel Aviv, losses are guaranteed because the 'dealing room' at the binary options firm controls the trading platform — like the crooked ownership of a rigged casino manipulating the roulette wheel".

In July 2016 the Israeli binary option firms Vault Options and Global Trader 365 were ordered by the U.S. District Court for the Northern District of Illinois to pay more than \$4.5 million for unlawful off-exchange binary options trading, fraud, and registration violations. The companies were also banned permanently from operating in the United States or selling to U.S. residents.

In November 2016 the Israel Securities Authority carried out a raid on the Ramat Gan offices of binary option broker iTrader. The CEO and six other employees were charged with fraud, providing unlicensed investment advice, and obstruction of justice.

On May 15, 2017, Eliran Saada, the owner of Express Target Marketing, which has operated the binary options companies InsideOption and SecuredOptions, was arrested on suspicion of fraud, false accounting, forgery, extortion, and blackmail. The case involves a Singaporean woman who claims to have lost over \$500,000 to the firm.

In August 2017 Israeli police superintendent Rafi Biton said that the binary trading industry had "turned into a monster". He told the Israeli Knesset that criminal investigations had begun.

In September 2017, the FBI arrested Lee Elbaz, CEO of binary options trading company Yukom Communications, upon her arrival in the United States. They arrested her for wire fraud and conspiracy to commit wire fraud.

In March 2013 the Malta Financial Services Authority (MFSA) announced that binary options regulation would be transferred away from Malta's Lottery and Gaming Authority. On 18 June 2013 MFSA confirmed that in their view binary options fell under the scope of the Markets in Financial Instruments Directive (MiFID), which made Malta the second EU jurisdiction to regulate binary options as a financial instrument. This required providers to obtain a category 3 Investment Services license and conform to MiFID's minimum capital requirements; firms could previously operate from the jurisdiction with a valid Lottery and Gaming Authority license.

In April 2017, New Zealand's Financial Markets Authority (FMA) announced that all brokers that offer short-term investment instruments that settle within three days are required to obtain a license from the agency. This is intended to cover binary options as well as contracts for difference (CFDs).

As of September 2017 binary options were regulated by the Gambling Commission rather than the Financial Conduct Authority (FCA), so investments in them are not protected by the financial services complaints and compensation scheme. The FCA in 2016 did propose bringing binary options under its jurisdiction and restricting them. They stated that binary options “did not appear to meet a genuine investment need”.

The Isle of Man, a self-governing Crown dependency for which the UK is responsible, has issued licenses to companies offering binary options as "games of skill" licensed and regulated under fixed odds betting by the Isle of Man Gambling Supervision Commission (GSC). This positions binary options as a form of gambling, and the administrator of the trading as something akin to a casino, as opposed to an exchange or brokerage house.

On October 19, 2017, London police raided 20 binary options firms in London.

Fraud

Fraud within the market is rife, with many binary options providers using the names of famous and respectable people without their knowledge. According to a national fraud and cybercrime reporting centre Action Fraud, 664 binary options frauds were reported in 2015/16, increasing to 1,474 in 2016/17. The City of London police in

May 2017 said that reported losses for the previous financial year were £13 million, increased from £2 million the year before. In the first half of 2017, 697 people reported losses totaling over £18 million.

In the United States, the Securities and Exchange Commission approved exchange-traded binary options in 2008. Trading commenced on the American Stock Exchange (AMEX) and the Chicago Board Options Exchange (CBOE) in May and June 2008.

AMEX (now NYSE American) offers binary options on some exchange-traded funds and a few highly liquid equities such as Citigroup and Google. On the exchange binary options were called "fixed return options" (FROs); calls were named "finish high" and puts were named "finish low". To reduce the threat of market manipulation of single stocks, FROs use a "settlement index" defined as a volume-weighted average of trades on the expiration day. AMEX and Donato A. Montanaro submitted a patent application for exchange-listed binary options using a volume-weighted settlement index in 2005.

CBOE offers binary options on the S&P 500 (SPX) and the CBOE Volatility Index (VIX). The tickers for these are BSZ and BVZ, respectively.

In 2009 Nadex, a U.S.-based exchange, launched binary options for a range of forex, commodities, and stock indices' markets.

Fraud

On June 6, 2013, the U.S. Commodity Futures Trading Commission (CFTC) and the Securities and Exchange Commission jointly issued an Investor Alert to warn about fraudulent promotional schemes involving binary options and binary options trading platforms. The two agencies said that they had received numerous complaints of fraud about binary options trading sites, "including refusal to credit customer accounts or reimburse funds to customers; identity theft; and manipulation of software to generate losing trades". Other binary options operations were violating requirements to register with regulators.

In 2013, U.S. regulators charged Israeli-Cypriot company Banc De Binary with illegally selling binary options to U.S. investors. Three years later, the company reached an \$11 million settlement with U.S. authorities. Regulators found the company used a "virtual office" in New York's Trump Tower in pursuit of its scheme, evading a ban on off-exchange binary option contracts. The company neither admitted nor denied the allegations.

In February 2017 the *Times of Israel* reported that the FBI was conducting an active international investigation of binary option fraud, emphasizing its international nature, saying that the agency was "not limited to the USA". Victims from around the world were asked to contact an FBI field office or the FBI's Internet Crime Complaint Center. The investigation is not limited to the binary options brokers, but is comprehensive and could include companies that provide services that allow the industry to operate. Credit card issuers will be informed of the fraudulent nature of much of the industry, which could possibly allow victims to receive a chargeback, or refund, of fraudulently obtained money.

On March 13, 2017, the FBI reiterated its warning, declaring that the "perpetrators behind many of the binary options websites, primarily criminals located overseas, are only interested in one thing—taking your money". They also provide a checklist on how to avoid being victimized.

Currency swap

In finance, a currency swap (more typically termed a cross-currency swap (XCS)) is an interest rate derivative (IRD). In particular it is a linear IRD and one of the most liquid, benchmark products spanning multiple currencies simultaneously. It has pricing associations with interest rate swaps (IRSs), foreign exchange (FX) rates, and FX swaps (FXSs).

A cross-currency swap's (XCS's) effective description is a derivative contract, agreed between two counterparties, which specifies the nature of an exchange of payments benchmarked against two interest rate indexes denominated in two different currencies. It also specifies an initial exchange of notional currency in each different currency and the terms of that repayment of notional currency over the life of the swap.

The most common XCS, and that traded in interbank markets, is a mark-to-market (MTM) XCS, whereby notional exchanges are regularly made throughout the life of the swap according to FX rate fluctuations. This is done to maintain a swap whose MTM value remains neutral and does not become either a large asset or liability (due to FX rate fluctuations) throughout its life.

The more unconventional, but simpler to define, non-MTM XCS includes an upfront notional exchange of currencies with a re-exchange of that same notional at maturity of the XCS.

The floating index referenced in each currency is commonly the 3-month tenor interbank offered rate (IBOR) in the appropriate currency, for example LIBOR in USD, GBP, EURIBOR in EUR or STIBOR in SEK.

Each series of payments (either denominated in the first currency or the second) is termed a 'leg', so a typical XCS has two legs, composed separately of interest payments and notional exchanges. To completely determine any XCS a number of parameters must be specified for each leg; the notional principal amount (or varying notional schedule including exchanges), the start and end dates and date scheduling, the chosen floating interest rate indexes and tenors, and day count conventions for interest calculations.

The pricing element of a XCS is what is known as the **basis spread**, which is the agreed amount chosen to be added (or reduced in the case of a negative spread) to one leg of the swap. Usually this is the domestic leg, or non-USD leg. For example a EUR/USD XCS would have the basis spread attached to the EUR denominated leg.

XCSs are over-the-counter (OTC) derivative

As OTC instruments, cross-currency swaps (XCSs) can be customised in a number of ways and can be structured to meet the specific needs of the counterparties. For example; payment dates could be irregular, the notional of the swap could be amortized over time, reset dates (or fixing dates) of the floating rate could be irregular, mandatory break clauses may be inserted into the contract, FX notional payments and FX rates may be manually specified etc.

Additionally it is not a requirement for swaps to have two floating legs. This leads to the naming convention of different types of XCS:

1. **(Floating v Floating) Cross-Currency Swaps:** are the normal, interbank traded products.
2. **(Fixed v Floating) Cross-Currency Swaps:** are a common customization of the benchmark product, often synthesized or hedged by market-makers by trading a float v float XCS and a standard interest rate swap (IRS) to convert the floating leg to a fixed leg.
3. **(Fixed v Fixed) Cross-Currency Swaps:** a less common customization, again synthesized by market makers trading two IRSs in each currency and a float v float XCS.
4. **Mark-to-Market or Non Mark-to-Market:** the MTM element and notional exchanges are usually standard (in interbank markets) but the customization to exclude this is available.
5. **Non-deliverable Cross-Currency Swap (NDXCS or NDS):** similar to a regular XCS, except that payments in one of the currencies are settled in another currency using the prevailing FX spot rate. NDS are usually used in emerging markets where the currency is illiquid, subject to exchange restrictions, or even non-convertible. This associates with quantos.
6. **Embedded options:** exotic customization options exist potentially with FX options at the maturity of the trade, or swaptions.

Uses

Currency swaps have many uses, some are itemized:

- To secure cheaper debt (by borrowing at the best available rate regardless of currency and then swapping for debt in desired currency using a back-to-back-loan).
- To hedge against (reduce exposure to) forward exchange rate fluctuations.
- To defend against financial turmoil by allowing a country beset by a liquidity crisis to borrow money from others with its own currency.

Additionally, cross-currency swaps are an integral component in modern financial markets as they are the bridge needed for assessment of yields on a standardised USD basis. For this reason they are also used as the construction tool in creating collateralized discount curves for valuing a future cashflow in a given currency but collateralized with another currency. Given the importance of collateral to the financial system at large, cross-currency swaps are important as a hedging instrument to insure against material collateral mismatches and devaluation.

For instance, a US-based company needing to borrow Swiss francs, and a Swiss-based company needing to borrow a similar present value in US dollars, could both reduce their exposure to exchange rate fluctuations by arranging either of the following:

- If the companies have already borrowed in the currencies each needs the principal in, then exposure is reduced by swapping cash flows only, so that each company's finance cost is in that company's domestic currency.
- Alternatively, the companies could borrow in their own domestic currencies (and may well each have comparative advantage when doing so), and then get the principal in the currency they desire with a principal-only swap.

Suppose the British Petroleum Company plans to issue five-year bonds worth £100 million at 7.5% interest, but actually needs an equivalent amount in dollars, \$150 million (current \$/£ rate is \$1.50/£), to finance its new refining facility in the U.S. Also, suppose that the Piper Shoe Company, a U. S. company, plans to issue \$150 million in bonds at 10%, with a maturity of five years, but it really needs £100 million to set up its distribution center in London. To meet each other's needs, suppose that both companies go to a swap bank that sets up the following agreements:

- Agreement 1:

The British Petroleum Company will issue 5-year £100 million bonds paying 7.5% interest. It will then deliver the £100 million to the swap bank who will pass it on to

the U.S. Piper Company to finance the construction of its British distribution center. The Piper Company will issue 5-year \$150 million bonds paying 10% interest. The Piper Company will then pass the \$150 million to swap bank that will pass it on to the British Petroleum Company who will use the funds to finance the construction of its U.S. refinery.

- Agreement 2:

The British company, with its U.S. asset (refinery), will pay the 10% interest on \$150 million (\$15 million) to the swap bank who will pass it on to the American company so it can pay its U.S. bondholders. The American company, with its British asset (distribution center), will pay the 7.5% interest on £100 million $((.075)(£100m) = £7.5 \text{ million})$, to the swap bank who will pass it on to the British company so it can pay its British bondholders.

- Agreement 3:

At maturity, the British company will pay \$150 million to the swap bank who will pass it on to the American company so it can pay its U.S. bondholders. At maturity, the American company will pay £100 million to the swap bank who will pass it on to the British company so it can pay its British bondholders.

It is well recognized that traditional "textbook" theory does not price cross currency (basis) swaps correctly, because it assumes the funding cost in each currency to be equal to its floating rate, thus always giving a zero cross currency spread. This is clearly contrary to what is observed in the market. In reality, market participants have different levels of access to funds in different currencies and therefore their funding costs are not always equal to LIBOR.

An approach to work around this is to select one currency as the funding currency (e.g. USD), and select one curve in this currency as the discount curve (e.g. USD interest rate swap curve against 3M LIBOR). Cashflows in the funding currency are discounted on this curve. Cashflows in any other currency are first swapped into the funding currency via a cross currency swap and then discounted.

XCSs expose users to many different types of financial risk.

Predominantly they expose the user to market risks. The value of a XCS will change as market interest rates, FX rates, and XCS rates rise and fall. In market terminology this is often referred to as delta and basis risks. Other specific types of market risk that interest rate swaps have exposure to are single currency basis risks (where various IBOR tenor indexes can deviate from one another) and reset risks (where the

publication of specific tenor IBOR indexes are subject to daily fluctuation). XCSs also exhibit gamma risk whereby their delta risk, basis risks or FX exposures, increase or decrease as market interest rates fluctuate.

Uncollateralised XCSs (that are those executed bilaterally without a credit support annex (CSA) in place) expose the trading counterparties to funding risks and credit risks. Funding risks because the value of the swap might deviate to become so negative that it is unaffordable and cannot be funded. Credit risks because the respective counterparty, for whom the value of the swap is positive, will be concerned about the opposing counterparty defaulting on its obligations.

Collateralised XCSs expose the users to collateral risks. Depending upon the terms of the CSA, the type of posted collateral that is permitted might become more or less expensive due to other extraneous market movements. Credit and funding risks still exist for collateralised trades but to a much lesser extent.

Due to regulations set out in the Basel III Regulatory Frameworks trading interest rate derivatives commands a capital usage. Dependent upon their specific nature XCSs might command more capital usage and this can deviate with market movements. Thus capital risks are another concern for users.

Reputation risks also exist. The mis-selling of swaps, over-exposure of municipalities to derivative contracts, and IBOR manipulation are examples of high-profile cases where trading interest rate swaps has led to a loss of reputation and fines by regulators.

Hedging XCSs can be complicated and relies on numerical processes of well designed risk models to suggest reliable benchmark trades that mitigate all market risks. The other, aforementioned risks must be hedged using other systematic processes.

The market-making of XCSs is an involved process involving multiple tasks; curve construction with reference to interbank markets, individual derivative contract pricing, risk management of credit, cash and capital. The cross disciplines required include quantitative analysis and mathematical expertise, disciplined and organized approach towards profits and losses, and coherent psychological and subjective assessment of financial market information and price-taker analysis. The time sensitive nature of markets also creates a pressurized environment. Many tools and techniques have been designed to improve efficiency of market-making in a drive to efficiency and consistency.

In the 1990s Goldman Sachs and other US banks offered Mexico, currency swaps and loans using Mexican oil reserves as collateral and as a means of payment.

The collateral of Mexican oil was valued at \$23.00 per barrel.

In May 2011, Charles Munger of Berkshire Hathaway Inc. accused international investment banks of facilitating market abuse by national governments. For example, "Goldman Sachs helped Greece raise \$1 billion of off- balance-sheet funding in 2002 through a currency swap, allowing the government to hide debt." Greece had previously succeeded in getting clearance to join the euro on 1 January 2001, in time for the physical launch in 2002, by faking its deficit figures.

Currency swaps were originally conceived in the 1970s to circumvent foreign exchange controls in the United Kingdom. At that time, UK companies had to pay a premium to borrow in US Dollars. To avoid this, UK companies set up back-to-back loan agreements with US companies wishing to borrow Sterling. While such restrictions on currency exchange have since become rare, savings are still available from back-to-back loans due to comparative advantage.

The first formal currency swap, as opposed to the then used parallel loans structure, was transacted by Citicorp International Bank for a \$US100,000,000 10 year US Dollar Sterling swap between Mobil Oil Corporation and General Electric Corporation Ltd (UK). The concept of the interest rate swap was developed by the Citicorp International Swap unit but cross-currency interest rate swaps were introduced by the World Bank in 1981 to obtain Swiss francs and German marks by exchanging cash flows with IBM. This deal was brokered by Salomon Brothers with a notional amount of \$210 million and a term of over ten years.

During the global financial crisis of 2008, the currency swap transaction structure was used by the United States Federal Reserve System to establish central bank liquidity swaps. In these, the Federal Reserve and the central bank of a developed or stable emerging economy agree to exchange domestic currencies at the current prevailing market exchange rate & agree to reverse the swap at the same exchange rate at a fixed future date. The aim of central bank liquidity swaps is "to provide liquidity in U.S. dollars to overseas markets." While central bank liquidity swaps and currency swaps are structurally the same, currency swaps are commercial transactions driven by comparative advantage, while central bank liquidity swaps are emergency loans of US Dollars to overseas markets, and it is currently unknown whether or not they will be beneficial for the Dollar or the US in the long-term.

The People's Republic of China has multiple year currency swap agreements of the Renminbi with Argentina, Belarus, Brazil, Hong Kong, Iceland, Indonesia, Malaysia, Russia, Singapore, South Korea, United Kingdom and Uzbekistan that perform a similar function to central bank liquidity swaps.

South Korea and Indonesia signed a won-rupiah currency swap deal worth US\$10 billion in October, 2013. The two nations can exchange up to 10.7 trillion won or 115 trillion rupiah for three years. The three-year currency swap could be renewed if both sides agree at the time of expiration. It is anticipated to promote bilateral trade and strengthen financial cooperation for the economic development of the two countries. The arrangement also ensures the settlement of trade in local currency between the two countries even in times of financial stress to support regional financial stability. As of 2013, South Korea imported goods worth \$13.2 billion from Indonesia, while its exports reached \$11.6 billion.

Bitcoin

Bitcoin is a cryptocurrency and worldwide payment system. It is the first decentralized digital currency, as the system works without a central bank or single administrator. The network is peer-to-peer and transactions take place between users directly, without an intermediary. These transactions are verified by network nodes through the use of cryptography and recorded in a public distributed ledger called a blockchain. Bitcoin was invented by an unknown person or group of people under the name Satoshi Nakamoto and released as open-source software in 2009.

Bitcoins are created as a reward for a process known as mining. They can be exchanged for other currencies, products, and services. As of February 2015, over 100,000 merchants and vendors accepted bitcoin as payment. Research produced by the University of Cambridge estimates that in 2017, there were 2.9 to 5.8 million unique users using a cryptocurrency wallet, most of them using bitcoin.

The word *bitcoin* first occurred and was defined in the white paper that was published on 31 October 2008. It is a compound of the words *bit* and *coin*. The white paper frequently uses the shorter *coin*.

There is no uniform convention for *bitcoin* capitalization. Some sources use *Bitcoin*, capitalized, to refer to the technology and network and *bitcoin*, lowercase, to refer to the unit of account. *The Wall Street Journal*, *The Chronicle of Higher Education*, and the *Oxford English Dictionary* advocate use of lowercase *bitcoin* in all cases, a convention followed throughout this article.

The unit of account of the bitcoin system is a *bitcoin*. Ticker symbols used to represent bitcoin are BTC and XBT. Its Unicode character is ₿. Small amounts of bitcoin used as alternative units are millibitcoin (mBTC), and satoshi (sat). Named in homage to bitcoin's creator, a *satoshi* is the smallest amount within bitcoin representing 0.00000001 bitcoins, one hundred millionth of a bitcoin. A *millibitcoin* equals 0.001 bitcoins, one thousandth of a bitcoin or 100,000 satoshis.

On 18 August 2008, the domain name "bitcoin.org" was registered. In November that year, a link to a paper authored by Satoshi Nakamoto titled *Bitcoin: A Peer-to-Peer*

Electronic Cash System was posted to a cryptography mailing list. Nakamoto implemented the bitcoin software as open source code and released it in January 2009 on SourceForge. The identity of Nakamoto remains unknown.

In January 2009, the bitcoin network came into existence after Satoshi Nakamoto mined the first ever block on the chain, known as the *genesis block*. Embedded in the coinbase of this block was the following text:

The Times 03/Jan/2009 Chancellor on brink of second bailout for banks.

This note has been interpreted as both a timestamp of the genesis date and a derisive comment on the instability caused by fractional-reserve banking. The receiver of the first bitcoin transaction was cypherpunk Hal Finney, who created the first reusable proof-of-work system (RPOW) in 2004. Finney downloaded the bitcoin software the day it was released, and received 10 bitcoins from Nakamoto. Other early cypherpunk supporters were Wei Dai, creator of bitcoin predecessor *b-money*, and Nick Szabo, creator of bitcoin predecessor *bit gold*.

In the early days, Nakamoto is estimated to have mined 1 million bitcoins. In 2010, Nakamoto handed the network alert key and control of the Bitcoin Core code repository over to Gavin Andresen, who later became lead developer at the Bitcoin Foundation. Nakamoto subsequently disappeared from any involvement in bitcoin. Andresen stated he then sought to decentralize control, saying: "As soon as Satoshi stepped back and threw the project onto my shoulders, one of the first things I did was try to decentralize that. So, if I get hit by a bus, it would be clear that the project would go on." This left opportunity for controversy to develop over the future development path of bitcoin.

On 1 August 2017, a hard fork of bitcoin was created, known as Bitcoin Cash. Bitcoin Cash has a larger block size limit and had an identical blockchain at the time of fork. On 12 November another hard fork, Bitcoin Gold, was created. Bitcoin Gold changes the proof-of-work algorithm used in mining.

The *blockchain* is a public ledger that records bitcoin transactions. A novel solution accomplishes this without any trusted central authority: the maintenance of the blockchain is performed by a network of communicating nodes running bitcoin software. Transactions of the form *payer X sends Y bitcoins to payee Z* are broadcast to this network using readily available software applications. Network nodes can validate transactions, add them to their copy of the ledger, and then broadcast these ledger additions to other nodes. The blockchain is a distributed database – to achieve independent verification of the chain of ownership of any and

every bitcoin amount, each network node stores its own copy of the blockchain. Approximately six times per hour, a new group of accepted transactions, a block, is created, added to the blockchain, and quickly published to all nodes. This allows bitcoin software to determine when a particular bitcoin amount has been spent, which is necessary in order to prevent double-spending in an environment without central oversight. Whereas a conventional ledger records the transfers of actual bills or promissory notes that exist apart from it, the blockchain is the only place that bitcoins can be said to exist in the form of unspent outputs of transactions.

Transactions are defined using a Forth-like scripting language. Transactions consist of one or more *inputs* and one or more *outputs*. When a user sends bitcoins, the user designates each address and the amount of bitcoin being sent to that address in an output. To prevent double spending, each input must refer to a previous unspent output in the blockchain. The use of multiple inputs corresponds to the use of multiple coins in a cash transaction. Since transactions can have multiple outputs, users can send bitcoins to multiple recipients in one transaction. As in a cash transaction, the sum of inputs (coins used to pay) can exceed the intended sum of payments. In such a case, an additional output is used, returning the change back to the payer. Any input satoshis not accounted for in the transaction outputs become the transaction fee.

Paying a transaction fee is optional. Miners can choose which transactions to process, and they are incentivised to prioritize those that pay higher fees.

Because the size of mined blocks is capped by the network, miners choose transactions based on the fee paid relative to their storage size, not the absolute amount of money paid as a fee. Thus, fees are generally measured in *satoshis per byte*, or *sat/b*. The size of transactions is dependent on the number of inputs used to create the transaction, and the number of outputs.

In the blockchain, bitcoins are registered to bitcoin addresses. Creating a bitcoin address is nothing more than picking a random valid private key and computing the corresponding bitcoin address. This computation can be done in a split second. But the reverse (computing the private key of a given bitcoin address) is mathematically unfeasible and so users can tell others and make public a bitcoin address without compromising its corresponding private key. Moreover, the number of valid private keys is so vast that it is extremely unlikely someone will compute a key-pair that is already in use and has funds. The vast number of valid private keys makes it unfeasible that brute force could be used for that. To be able to spend the bitcoins, the

owner must know the corresponding private key and digitally sign the transaction. The network verifies the signature using the public key.

If the private key is lost, the bitcoin network will not recognize any other evidence of ownership; the coins are then unusable, and effectively lost. For example, in 2013 one user claimed to have lost 7,500 bitcoins, worth \$7.5 million at the time, when he accidentally discarded a hard drive containing his private key. A backup of his key(s) would have prevented this.

Mining is a record-keeping service done through the use of computer processing power. Miners keep the blockchain consistent, complete, and unalterable by repeatedly grouping newly broadcast transactions into a *block*, which is then broadcast to the network and verified by recipient nodes. Each block contains a SHA-256 cryptographic hash of the previous block, thus linking it to the previous block and giving the blockchain its name.

To be accepted by the rest of the network, a new block must contain a so-called *proof-of-work*. The system used is based on Adam Back's 1997 anti-spam scheme, Hashcash. The PoW requires miners to find a number called a *nonce*, such that when the block content is hashed along with the nonce, the result is numerically smaller than the network's *difficulty target*. This proof is easy for any node in the network to verify, but extremely time-consuming to generate, as for a secure cryptographic hash, miners must try many different nonce values (usually the sequence of tested values is the ascending natural numbers: 0, 1, 2, 3, ...) before meeting the difficulty target.

Every 2,016 blocks (approximately 14 days at roughly 10 min per block), the difficulty target is adjusted based on the network's recent performance, with the aim of keeping the average time between new blocks at ten minutes. In this way the system automatically adapts to the total amount of mining power on the network. Between 1 March 2014 and 1 March 2015, the average number of nonces miners had to try before creating a new block increased from 16.4 quintillion to 200.5 quintillion.

The proof-of-work system, alongside the chaining of blocks, makes modifications of the blockchain extremely hard, as an attacker must modify all subsequent blocks in order for the modifications of one block to be accepted. As new blocks are mined all the time, the difficulty of modifying a block increases as time passes and the number of subsequent blocks (also called *confirmations* of the given block) increases.

Computing power is often bundled together or "pooled" to reduce variance in miner income. Individual mining rigs often have to wait for long periods to confirm a block of transactions and receive payment. In a pool, all participating miners get paid every

time a participating server solves a block. This payment depends on the amount of work an individual miner contributed to help find that block.

The successful miner finding the new block is rewarded with newly created bitcoins and transaction fees. As of 9 July 2016, the reward amounted to 12.5 newly created bitcoins per block added to the blockchain. To claim the reward, a special transaction called a *coinbase* is included with the processed payments. All bitcoins in existence have been created in such coinbase transactions. The bitcoin protocol specifies that the reward for adding a block will be halved every 210,000 blocks (approximately every four years). Eventually, the reward will decrease to zero, and the limit of 21 million bitcoins will be reached c. 2140; the record keeping will then be rewarded by transaction fees solely.

In other words, bitcoin's inventor Nakamoto set a monetary policy based on artificial scarcity at bitcoin's inception that there would only ever be 21 million bitcoins in total. Their numbers are being released roughly every ten minutes and the rate at which they are generated would drop by half every four years until all were in circulation.

A *wallet* stores the information necessary to transact bitcoins. While wallets are often described as a place to hold or store bitcoins, due to the nature of the system, bitcoins are inseparable from the blockchain transaction ledger. A better way to describe a wallet is something that "stores the digital credentials for your bitcoin holdings" and allows one to access (and spend) them. Bitcoin uses public-key cryptography, in which two cryptographic keys, one public and one private, are generated. At its most basic, a wallet is a collection of these keys.

There are three modes which wallets can operate in. They have an inverse relationship with regards to trustlessness and computational requirements.

- *Full clients* verify transactions directly on a local copy of the blockchain (over 150 GB As of January 2018). They are the most secure and reliable way of using the network, as trust in external parties is not required. Full clients check the validity of mined blocks, preventing them from transacting on a chain that breaks or alters network rules. Because of its size and complexity, storing the entire blockchain is not suitable for all computing devices.
- *Pruning clients* store only the set of transactions that have not been spent (the "UTXO set"), thereby reducing the size of data they need to store, while simultaneously allowing them to validate new transactions. However, if miners alter the blockchain at a point suitably far back in time (a "reorg"), the pruning client must re-validate the entire blockchain from its genesis.

- *Lightweight clients* consult full clients to send and receive transactions without requiring a local copy of the entire blockchain. This makes lightweight clients much faster to set up and allows them to be used on low-power, low-bandwidth devices such as smartphones. When using a lightweight wallet, however, the user must trust the server to a certain degree, as it can report faulty values back to the user. Lightweight clients follow the longest blockchain and do not ensure it is valid, requiring trust in miners.

Third-party internet services called *online wallets* offer similar functionality but may be easier to use. In this case, credentials to access funds are stored with the online wallet provider rather than on the user's hardware. As a result, the user must have complete trust in the wallet provider. A malicious provider or a breach in server security may cause entrusted bitcoins to be stolen. An example of such a security breach occurred with Mt. Gox in 2011. This has led to the often-repeated meme "Not your keys, not your bitcoin" .

Physical wallets store offline the credentials necessary to spend bitcoins. One notable example was a novelty coin with these credentials printed on the reverse side. *Paper wallets* are simply paper printouts.

Another type of wallet called a *hardware wallet* keeps credentials offline while facilitating transactions.

The first wallet program – simply named "Bitcoin" – was released in 2009 by Satoshi Nakamoto as open-source code. In version 0.5 the client moved from the wxWidgets user interface toolkit to Qt, and the whole bundle was referred to as "Bitcoin-Qt". After the release of version 0.9, the software bundle was renamed "Bitcoin Core" to distinguish itself from the underlying network. It is sometimes referred to as the "Satoshi client".

While a decentralized system cannot have an "official" implementation, Bitcoin Core is considered by some to be bitcoin's preferred implementation. Today, other alternative clients exist, such as Bitcoin XT, Bitcoin Unlimited, and Parity Bitcoin.

Bitcoin was designed not to need a central authority and the bitcoin network is considered to be decentralized. However, researchers have pointed out a visible "trend towards centralization" by the means of miners joining large mining pools to minimise the variance of their income. According to researchers, other parts of the ecosystem are also "controlled by a small set of entities", notably online wallets and simplified payment verification (SPV) clients.

Because transactions on the network are confirmed by miners, decentralization of the network requires that no single miner or mining pool obtains 51% of the hashing power, which would allow them to double-spend coins, prevent certain transactions from being verified and prevent other miners from earning income. As of 2013 just six mining pools controlled 75% of overall bitcoin hashing power.

In 2014 mining pool Ghash.io obtained 51% hashing power which raised significant controversies about the safety of the network. The pool has voluntarily capped their hashing power at 39.99% and requested other pools to act responsibly for the benefit of the whole network.

Bitcoin is pseudonymous, meaning that funds are not tied to real-world entities but rather bitcoin addresses. Owners of bitcoin addresses are not explicitly identified, but all transactions on the blockchain are public. In addition, transactions can be linked to individuals and companies through "idioms of use" (e.g., transactions that spend coins from multiple inputs indicate that the inputs may have a common owner) and corroborating public transaction data with known information on owners of certain addresses. Additionally, bitcoin exchanges, where bitcoins are traded for traditional currencies, may be required by law to collect personal information.

To heighten financial privacy, a new bitcoin address can be generated for each transaction. For example, hierarchical deterministic wallets generate pseudorandom "rolling addresses" for every transaction from a single seed, while only requiring a single passphrase to be remembered to recover all corresponding private keys. Researchers at Stanford University and Concordia University have also shown that bitcoin exchanges and other entities can prove assets, liabilities, and solvency without revealing their addresses using zero-knowledge proofs. "Bulletproofs," a version of Confidential Transactions proposed by Greg Maxwell, have been tested by Professor Dan Boneh of Stanford. Other solutions such as Merkelized Abstract Syntax Trees (MAST), pay-to-script-hash (P2SH) with MERKLE-BRANCH-VERIFY, and "Tail Call Execution Semantics, have also been proposed to support private smart contracts.

Wallets and similar software technically handle all bitcoins as equivalent, establishing the basic level of fungibility. Researchers have pointed out that the history of each bitcoin is registered and publicly available in the blockchain ledger, and that some users may refuse to accept bitcoins coming from controversial transactions, which would harm bitcoin's fungibility. Projects such as CryptoNote, Zerocoin, and Dark Wallet aim to address these privacy and fungibility issues.

The blocks in the blockchain were not limited originally. The block size limit of one megabyte was introduced by Satoshi Nakamoto in 2010, as an anti-spam

measure. Eventually the block size limit of one megabyte created problems for transaction processing, such as increasing transaction fees and delayed processing of transactions that cannot be fit into a block.

On 24 August 2017 (at block 481,824), Segregated Witness (SegWit) went live, introducing a new transaction format where signature data is separated and known as the *witness*. The upgrade replaced the block size limit with a limit on a new measure called *block weight*, which counts non-witness data four times as much as witness data, and allows a maximum weight of 4 megabytes. Thus, per computer scientist Jochen Hoenicke, the actual block capacity depends on the ratio of SegWit transactions in the block, and on the ratio of signature data. Based on his estimate, if the ratio of SegWit transactions is 50%, the block capacity may be 1.25 megabytes. According to Hoenicke, if native SegWit addresses from Bitcoin Core version 0.16.0 are used, and SegWit adoption reaches 90 to 95%, a block size of up to 1.8 megabytes is possible.

Bitcoin is a digital asset designed by its inventor, Satoshi Nakamoto, to work as a currency. It is commonly referred to with terms like digital currency, digital cash, virtual currency, electronic currency, or cryptocurrency.

The question whether bitcoin is a currency or not is still disputed. Bitcoins have three useful qualities in a currency, according to *The Economist* in January 2015: they are "hard to earn, limited in supply and easy to verify". Economists define money as a store of value, a medium of exchange, and a unit of account and agree that bitcoin has some way to go to meet all these criteria. It does best as a medium of exchange; as of February 2015 the number of merchants accepting bitcoin had passed 100,000. As of March 2014, the bitcoin market suffered from volatility, limiting the ability of bitcoin to act as a stable store of value, and retailers accepting bitcoin use other currencies as their principal unit of account.

According to research produced by Cambridge University, there were between 2.9 million and 5.8 million unique users using a cryptocurrency wallet, as of 2017, most of them using bitcoin. The number of users has grown significantly since 2013, when there were 300,000 to 1.3 million users.

In 2015, the number of merchants accepting bitcoin exceeded 100,000. Instead of 2–3% typically imposed by credit card processors, merchants accepting bitcoins often pay fees under 2%, down to 0%. Firms that accepted payments in bitcoin as of December 2014 included PayPal, Microsoft, Dell, and Newegg. In 2017 bitcoin's acceptance among major online retailers included three out of the top 500 online merchants, down from five in 2016. Reasons for this fall include high transaction fees due to bitcoin's scalability issues, long transaction times and a rise in value making

consumers unwilling to spend it. In November 2017 PwC accepted bitcoin at its Hong Kong office in exchange for providing advisory services to local companies who are specialists in blockchain technology and cryptocurrencies, the first time any Big Four accounting firm accepted the cryptocurrency as payment.

Merchants accepting bitcoin ordinarily use the services of bitcoin payment service providers such as BitPay or Coinbase. When a customer pays in bitcoin, the payment service provider accepts the bitcoin on behalf of the merchant, converts it to the local currency, and sends the obtained amount to merchant's bank account, charging a fee for the service.

Bitcoins can be bought on digital currency exchanges. According to Tony Gallippi, a co-founder of BitPay, "banks are scared to deal with bitcoin companies, even if they really want to". In 2014, the National Australia Bank closed accounts of businesses with ties to bitcoin, and HSBC refused to serve a hedge fund with links to bitcoin. Australian banks in general have been reported as closing down bank accounts of operators of businesses involving the currency; this has become the subject of an investigation by the Australian Competition and Consumer Commission. Nonetheless, Australian banks have trialled trading between each other using the blockchain technology on which bitcoin is based.

In a 2013 report, Bank of America Merrill Lynch stated that "we believe bitcoin can become a major means of payment for e-commerce and may emerge as a serious competitor to traditional money-transfer providers." In June 2014, the first bank that converts deposits in currencies instantly to bitcoin without any fees was opened in Boston.

Plans were announced to include a bitcoin futures option on the Chicago Mercantile Exchange in 2017. Trading in bitcoin futures was announced to begin on 10 December 2017.

Some Argentinians have bought bitcoins to protect their savings against high inflation or the possibility that governments could confiscate savings accounts. During the 2012–2013 Cypriot financial crisis, bitcoin purchases in Cyprus rose due to fears that savings accounts would be confiscated or taxed.

The Winklevoss twins have invested into bitcoins. In 2013 *The Washington Post* claimed that they owned 1% of all the bitcoins in existence at the time.

Other methods of investment are bitcoin funds. The first regulated bitcoin fund was established in Jersey in July 2014 and approved by the Jersey Financial Services

Commission. *Forbes* started publishing arguments in favor of investing in December 2015.

In 2013 and 2014, the European Banking Authority and the Financial Industry Regulatory Authority (FINRA), a United States self-regulatory organization, warned that investing in bitcoins carries significant risks. *Forbes* named bitcoin the best investment of 2013. In 2014, Bloomberg named bitcoin one of its worst investments of the year. In 2015, bitcoin topped Bloomberg's currency tables.

According to bitinfocharts.com, in 2017 there are 9,272 bitcoin wallets with more than \$1 million worth of bitcoins. The exact number of bitcoin millionaires is uncertain as a single person can have more than one bitcoin wallet.

Venture capitalists, such as Peter Thiel's Founders Fund, which invested US\$3 million in BitPay, do not purchase bitcoins themselves, instead funding bitcoin infrastructure like companies that provide payment systems to merchants, exchanges, wallet services, etc. In 2012, an incubator for bitcoin-focused start-ups was founded by Adam Draper, with financing help from his father, venture capitalist Tim Draper, one of the largest bitcoin holders after winning an auction of 30,000 bitcoins, at the time called 'mystery buyer'. The company's goal is to fund 100 bitcoin businesses within 2–3 years with \$10,000 to \$20,000 for a 6% stake. Investors also invest in bitcoin mining. According to a 2015 study by Paolo Tasca, bitcoin startups raised almost \$1 billion in three years .

The price of bitcoins has gone through various cycles of appreciation and depreciation referred to by some as bubbles and busts. In 2011, the value of one bitcoin rapidly rose from about US\$0.30 to US\$32 before returning to US\$2. In the latter half of 2012 and during the 2012–13 Cypriot financial crisis, the bitcoin price began to rise, reaching a high of US\$266 on 10 April 2013, before crashing to around US\$50. On 29 November 2013, the cost of one bitcoin rose to a peak of US\$1,242. In 2014, the price fell sharply, and as of April remained depressed at little more than half 2013 prices. As of August 2014 it was under US \$600.

According to Mark T. Williams, as of 2014, bitcoin has volatility seven times greater than gold, eight times greater than the S&P 500, and 18 times greater than the US dollar. According to *Forbes*, there are uses where volatility does not matter, such as online gambling, tipping, and international remittances.

According to an article in *The Wall Street Journal*, as of 19 April 2016, bitcoin had been more stable than gold for the preceding 24 days, and it was suggested that its value might be more stable in the future. On 3 March 2017, the price of a bitcoin surpassed the market value of an ounce of gold for the first time as its price surged to

an all-time high of \$1,268. A study in *Electronic Commerce Research and Applications*, going back through the network's historical data, showed the value of the bitcoin network as measured by the price of bitcoins, to be roughly proportional to the square of the number of daily unique users participating on the network, i.e. that the network is "fairly well modeled by the Metcalfe's law".

Various journalists, economists, and the central bank of Estonia have voiced concerns that bitcoin is a Ponzi scheme. In 2013, Eric Posner, a law professor at the University of Chicago, stated that "a real Ponzi scheme takes fraud; bitcoin, by contrast, seems more like a collective delusion." A 2014 report by the World Bank concluded that bitcoin was not a deliberate Ponzi scheme. The Swiss Federal Council examined the concerns that bitcoin might be a pyramid scheme; it concluded that "Since in the case of bitcoin the typical promises of profits are lacking, it cannot be assumed that bitcoin is a pyramid scheme." In July 2017, billionaire Howard Marks referred to bitcoin as a pyramid scheme.

On 12 September 2017, Jamie Dimon, CEO of JP Morgan Chase, called bitcoin a "fraud" and said he would fire anyone in his firm caught trading it. Zero Hedge claimed that the same day Dimon made his statement, JP Morgan also purchased a large amount of bitcoins for its clients. In a January 2018 interview Dimon voiced regrets about his earlier remarks, and said "The blockchain is real. You can have cryptodollars in yen and stuff like that. ICOs ... you got to look at every one individually."

Bitcoin has been labelled a *speculative bubble* by many including former Fed Chairman Alan Greenspan and economist John Quiggin. Nobel Memorial Prize laureate Robert Shiller said that bitcoin "exhibited many of the characteristics of a speculative bubble". Journalist Matthew Boesler in 2013 rejected the speculative bubble label and saw bitcoin's quick rise in price as nothing more than normal economic forces at work. Timothy B. Lee, in a 2013 piece for *The Washington Post* pointed out that the observed cycles of appreciation and depreciation don't correspond to the definition of speculative bubble. On 14 March 2014, the American business magnate Warren Buffett said, "Stay away from it. It's a mirage, basically." During their time as bitcoin developers, Gavin Andresen and Mike Hearn warned that bubbles may occur.

Because of bitcoin's decentralized nature, nation-states cannot shut down the network or alter its technical rules. However, the use of bitcoin can be criminalized, and shutting down exchanges and the peer-to-peer economy in a given country would constitute a "de facto ban". The legal status of bitcoin varies substantially from country to country and is still undefined or changing in many of them. While some countries have explicitly allowed its use and trade, others have banned or restricted it.

Regulations and bans that apply to bitcoin probably extend to similar cryptocurrency systems.

Bitcoin has been criticized for the amounts of electricity consumed by mining. As of 2015, *The Economist* estimated that even if all miners used modern facilities, the combined electricity consumption would be 166.7 megawatts (1.46 terawatt-hours per year). At the end of 2017, the global bitcoin mining activity was estimated to consume between 1 and 4 gigawatts of electricity. Politico noted that the banking sector today consumes about 6% of total global power, and even if bitcoin's consumption levels increased 100 fold from today's levels, bitcoin's consumption would still only amount to about 2% of global power consumption.

To lower the costs, bitcoin miners have set up in places like Iceland where geothermal energy is cheap and cooling Arctic air is free. Bitcoin miners are known to use hydroelectric power in Tibet, Quebec, Washington (state), and Austria to reduce electricity costs. Miners are attracted to suppliers such as Hydro Quebec that have energy surpluses. According to a University of Cambridge study, much of bitcoin mining is done in China, where electricity is subsidized by the government.

The use of bitcoin by criminals has attracted the attention of financial regulators, legislative bodies, law enforcement, and the media. In the United States, the FBI prepared an intelligence assessment, the SEC issued a pointed warning about investment schemes using virtual currencies, and the U.S. Senate held a hearing on virtual currencies in November 2013.

Several news outlets have asserted that the popularity of bitcoins hinges on the ability to use them to purchase illegal goods. In 2014, researchers at the University of Kentucky found "robust evidence that computer programming enthusiasts and illegal activity drive interest in bitcoin, and find limited or no support for political and investment motives".

The *New York Post* has published a news article based on a report by researchers at Germany's RWTH Aachen University. The researchers said "Our analysis shows that certain content, e.g., illegal pornography, can render the mere possession of a blockchain illegal".

Currency future

A currency future, also known as an FX future or a foreign exchange future, is a futures contract to exchange one currency for another at a specified date in the future at a price (exchange rate) that is fixed on the purchase date. Typically, one of the currencies is the US dollar. The *price* of a future is then in terms of US dollars per unit of other currency. This can be different from the standard way of quoting in the spot foreign exchange markets. The *trade unit* of each contract is then a certain amount of other currency, for instance €125,000. Most contracts have physical delivery, so for those held at the end of the last trading day, actual payments are made in each currency. However, most contracts are closed out before that. Investors can close out the contract at any time prior to the contract's delivery date.

Currency futures were first created in 1970 at the International Commercial Exchange in New York. But the contracts did not "take off" because the Bretton Woods system was still in effect. They did so a full two years before the Chicago Mercantile Exchange (CME) in 1972, less than one year after the system of fixed exchange rates was abandoned along with the gold standard. Some commodity traders at the CME did not have access to the inter-bank exchange markets in the early 1970s, when they believed that significant changes were about to take place in the currency market. The CME actually now gives credit to the International Commercial Exchange (not to be confused with ICE) for creating the currency contract, and state that they came up with the idea independently of the International Commercial Exchange. The CME established the International Monetary Market (IMM) and launched trading in seven currency futures on May 16, 1972. Today, the IMM is a division of CME. In the fourth quarter of 2009, CME Group FX volume averaged 754,000 contracts per day, reflecting average daily notional value of approximately \$100 billion. Currently most of these are traded electronically.

Other futures exchanges that trade currency futures are Euronext.liffe, Tokyo Financial Exchange and Intercontinental Exchange .

As with other futures, the conventional maturity dates are the IMM dates, namely the third Wednesday in March, June, September and December. The conventional option maturity dates are the first Friday after the first Wednesday for the given month.

Investors use these futures contracts to hedge against foreign exchange risk. If an investor will receive a cashflow denominated in a foreign currency on some future date, that investor can lock in the current exchange rate by entering into an offsetting currency futures position that expires on the date of the cashflow.

For example, Jane is a US-based investor who will receive €1,000,000 on December 1. The current exchange rate implied by the futures is \$1.2/€. She can lock in this exchange rate by selling €1,000,000 worth of futures contracts expiring on December 1. That way, she is guaranteed an exchange rate of \$1.2/€ regardless of exchange rate fluctuations in the meantime.

Currency futures can also be used to speculate and, by incurring a risk, attempt to profit from rising or falling exchange rates.

For example, Peter buys 10 September CME Euro FX Futures for \$1,250,000 (each contract worth \$125,000), at \$1.2713/€. At the end of the day, the futures close at \$1.2784/€. The change in price is \$0.0071/€. As each contract is over €125,000, and he has 10 contracts, his profit is \$8,875. As with any future, this is paid to him immediately.

More generally, each change of \$0.0001/€ (the minimum Commodity tick size), is a profit or loss of \$12.50 per contract.

Private currency

A private currency is a currency issued by a private entity, be it an individual, a commercial business or a nonprofit enterprise. It is often contrasted with fiat currency issued by governments or central banks. In many countries, the issuance of private paper currencies is severely restricted by law.

Today, there are over four thousand privately issued currencies in more than 35 countries. These include commercial trade exchanges that use barter credits as units of exchange, private gold and silver exchanges, local paper money, computerized systems of credits and debits, and digital currencies in circulation, such as digital gold currency.

In the United States, the Free Banking Era lasted between 1837 and 1866, when almost anyone could issue paper money. States, municipalities, private banks, railroad and construction companies, stores, restaurants, churches and individuals printed an estimated 8,000 different types of money by 1860. If an issuer went bankrupt, closed, left town, or otherwise went out of business, the note would be worthless. Such organizations earned the nickname of "wildcat banks" for a reputation of unreliability; they were often situated in remote, unpopulated locales said to be inhabited more by wildcats than by people. The National Bank Act of 1863 ended the "wildcat bank" period.

In Australia, the Bank Notes Tax Act 1910 effectively shut down the circulation of private currencies by imposing a prohibitive tax on the practice. The Act was repealed by the *Commonwealth Bank Act* 1945, which imposed a fine for private currencies.

Now, s. 44(1) of the Australian *Reserve Bank Act 1959*, prohibits this practice. In 1976, Wickrema Weerasooria published an article which suggested that the issuing of bank cheques violated this section, though some banks responded that since bank cheques were printed with the words "not negotiable" on them, the cheques were not intended for circulation and thus did not violate the statute.

In Hong Kong, although the government issues currency, bank-issued private currency is the dominant medium of exchange. Most automated teller machines dispense private Hong Kong bank notes.

In Scotland, the Bank of Scotland, Clydesdale Bank, and the Royal Bank of Scotland, and in Northern Ireland, the Bank of Ireland, Danske Bank, First Trust Bank, and Ulster Bank, are authorised by Parliament to issue Pound sterling bank notes. They are subject to central bank (the Bank of England) regulations concerning "ring-fenced backing assets" and are backed in part by deposits at the Bank of England. They are exchangeable with other pound notes on a one-to-one basis, and circulate freely within the United Kingdom, though not legal tender, not even in Scotland and Northern Ireland. In fact, technically, no banknote (including Bank of England notes) qualifies as legal tender in Scotland or Northern Ireland.

England has had the Totnes pound since it was launched by Transition Towns Totnes Economics and Livelihoods group in March 2007; A Totnes Pound is equal to one pound sterling and is backed by sterling held in a bank account. As at September 2008, about 70 businesses in Totnes were accepting the Totnes Pound. Other local currencies launched since then include the Lewes Pound (2008), the Brixton Pound (2009), the Stroud Pound (2009) and the Bristol Pound, which also allows for electronic payments.

Austria had the Wörgl Experiment from July 1932 to September 1933.

Bavaria, Germany, has had the Chiemgauer since 2003. As of 2011 there were over 550,000 in circulation.

Since starting in 2006, the "City Initiative Karlsruhe" has issued the *Karlsruher* which has no nominal value. Every coin has the value of 50 Eurocents and is primarily used in parking garages. As of 2009, 120 companies in Karlsruhe accept the *Karlsruher* and usually grant a discount when paid with it.

In Canada, numerous complementary currencies are in use, such as the Calgary Dollar and Toronto dollar. However private currencies in Canada cannot be referred to as being legal tender and many private currencies (as well as loyalty programs) avoid the word "dollar", using names like "coupons" or "bucks", to avoid confusion. Examples include: Canadian Tire money and Pioneer Energy's Bonus Bucks.

Customer reward and loyalty programs operated by businesses are sometimes counted as private currencies. However, though "points" or "miles" may be exchangeable for merchandise or travel from the program sponsor, most of them lack the key element for currency of being a medium of exchange transferable to other individuals and usable as payment for items from other vendors. A few programs do have "partnerships" allowing this to some extent, and permit the transfer of points or miles. Some startups, such as the Canadian website Points.com, have sought to make loyalty

"points" more currency-like by creating an exchange where points from one loyalty program can be traded for points in other such programs.

A cryptocurrency is a form of digital or virtual currency where cryptography secures the transactions and controls the creation of additional units of the currency. A cryptocurrency wallet can be used to store the public and private keys which can be used to receive or spend the cryptocurrency. The cryptographic systems used allow for decentralisation; a decentralised cryptocurrency is fiat money but one without a central banking system. In terms of total market value, Bitcoin is the largest cryptocurrency, but there are over 700 digital currencies in existence.

On 6 August 2013, Federal Judge Amos Mazzant of the Eastern District of Texas of the Fifth Circuit ruled that bitcoins are "a currency or a form of money" (specifically securities as defined by Federal Securities Laws), and as such were subject to the court's jurisdiction. In August 2013, the German Finance Ministry characterized Bitcoin as a unit of account, usable in multilateral clearing circles and subject to capital gains tax if held less than one year.

In Thailand, lack of existing law leads many to believe Bitcoin is banned.

As national currencies can be counterfeited, so too can private currencies, and private currencies are subject to other criminal issues, including fraud.

The Liberty Dollar was a commodity-backed private currency created by Bernard von NotHaus and issued between 1998 and 2009. In 2011, von NotHaus was arrested and subsequently convicted on charges of money laundering, mail fraud, wire fraud, counterfeiting, and conspiracy. The charges stemmed from the government view that the Liberty silver coins too closely resembled official coinage.

In 2007, Angel Cruz, founder of The United Cities Corporation (TUC), announced he was establishing an alternative "asset based" currency named "United States Private Dollars". Cruz claimed United States Private Dollars were "backed by the total net worth of the assets of its members" and had printed six billion dollars' worth of the private currency. The backing assets were claimed to be valued at 357 billion dollars. The currency featured the slogan "In Jehovah We Trust". The Comptroller of the Currency issued an alert warning banks that checks issued by TUC were "valueless instruments" and should not be cashed. In 2008, Cruz was indicted by a Federal grand jury in Florida on one count of conspiracy to defraud the United States

under 18 U.S.C. § 1344 and 18 U.S.C. § 371 and six counts of bank fraud under 18 U.S.C. § 1344 and 18 U.S.C. § 2 in connection with his dealings with Bank of America, while attempting to get United Cities bank drafts cashed. As of late October 2010, Cruz was still a fugitive, though an associate was convicted on related charges and sentenced to prison for eight years.

Online banking

Online banking, also known as internet banking, is an electronic payment system that enables customers of a bank or other financial institution to conduct a range of financial transactions through the financial institution's website. The online banking system will typically connect to or be part of the core banking system operated by a bank and is in contrast to branch banking which was the traditional way customers accessed banking services.

To access a financial institution's online banking facility, a customer with internet access will need to register with the institution for the service, and set up a password and other credentials for customer verification. The credentials for online banking are normally not the same as for telephone or mobile banking. Financial institutions now routinely allocate customer numbers, whether or not customers have indicated an intention to access their online banking facility. Customer numbers are normally not the same as account numbers, because a number of customer accounts can be linked to the one customer number. Technically, the customer number can be linked to any account with the financial institution that the customer controls, though the financial institution may limit the range of accounts that may be accessed to, say, cheque, savings, loan, credit card and similar accounts.

The customer visits the financial institution's secure website, and enters the online banking facility using the customer number and credentials previously set up. The types of financial transactions which a customer may transact through online banking are determined by the financial institution, but usually includes obtaining account balances, a list of the recent transactions, electronic bill payments and funds transfers between a customer's or another's accounts. Most banks also enable a customer to download copies of bank statements, which can be printed at the customer's premises (some banks charge a fee for mailing hard copies of bank statements). Some banks also enable customers to download transactions directly into the customer's accounting software. The facility may also enable the customer to order a cheque book, statements, report loss of credit cards, stop payment on a cheque, advise change of address and other routine actions.

Today, many banks are internet-only institutions. These "virtual banks" have lower overhead costs than their brick-and-mortar counterparts. In the United States, many online banks are insured by the Federal Deposit Insurance Corporation (FDIC) and can offer the same level of protection for the customers' funds as traditional banks.

The precursor for the modern home loan banking services were the distance banking services over electronic media from the early 1980s. The term 'online' became popular in the late 1980s and referred to the use of a terminal, keyboard and TV (or monitor) to access the banking system using a phone line. 'Home banking' can also refer to the use of a numeric keypad to send tones down a phone line with instructions to the bank. Online services started in New York in 1981 when four of the city's major banks (Citibank, Chase Manhattan, Chemical and Manufacturers Hanover) offered home banking services using the videotex system. Because of the commercial failure of videotex, these banking services never became popular except in France (where the use of videotex (Minitel) was subsidised by the telecom provider) and the UK, where the Prestel system was used.

When the clicks-and-bricks euphoria hit in the late 1990s, many banks began to view web-based banking as a strategic imperative. The attraction of banks to online banking are fairly obvious: diminished transaction costs, easier integration of services, interactive marketing capabilities, and other benefits that boost customer lists and profit margins. Additionally, online banking services allow institutions to bundle more services into single packages, thereby luring customers and minimizing overhead.

A mergers-and-acquisitions wave swept the financial industries in the mid- and late 1990s, greatly expanding banks' customer bases. Following this, banks looked to the Web as a way of maintaining their customers and building loyalty. A number of different factors are causing bankers to shift more of their business to the virtual realm.

While financial institutions took steps to implement e-banking services in the mid-1990s, many consumers were hesitant to conduct monetary transactions over the internet. It took widespread adoption of electronic commerce, based on trailblazing companies such as America Online, Amazon.com and eBay, to make the idea of paying for items online widespread. By 2000, 80% of U.S. banks offered e-banking. Customer use grew slowly. At Bank of America, for example, it took 10 years to acquire 2 million e-banking customers. However, a significant cultural change took place after the Y2K scare ended. In 2001, Bank of America became the first bank to top 3 million online banking customers, more than 20% of its customer base. In comparison, larger national institutions, such as Citigroup claimed 2.2 million online relationships globally, while J.P. Morgan Chase estimated it had more than 750,000 online banking customers. Wells Fargo had 2.5 million online banking customers, including small businesses. Online customers proved more loyal and profitable than regular customers. In October 2001, Bank of America customers executed a record 3.1 million electronic bill payments, totaling more than \$1 billion. In 2009, a report by Gartner Group estimated that 47% of United States adults and 30% in the United Kingdom bank online.

The early 2000s saw the rise of the branch-less banks as internet only institutions. These internet-based banks incur lower overhead costs than their brick-and-mortar counterparts. In the United States, deposits at most direct banks are FDIC-insured and offer the same level of insurance protection as traditional banks.

Online banking was first introduced in the early 1980s in New York, United States. Four major banks — Citibank, Chase Bank, Chemical Bank and Manufacturers Hanover — offered home banking services. Chemical introduced its Pronto services for individuals and small businesses in 1983, which enabled individual and small-business clients to maintain electronic checkbook registers, see account balances, and transfer funds between checking and savings accounts. Pronto failed to attract enough customers to break even and was abandoned in 1989. Other banks had a similar experience.

Since its inception in the United States, online banking has been federally governed by the *Electronic Funds Transfer Act of 1978*.

Stanford Federal Credit Union was the first financial institution to offer online internet banking services to all of its members in October 1994.

Almost simultaneously with the United States, online banking arrived in the United Kingdom. The UK's first home online banking services known as Homelink was set up by Bank of Scotland for customers of the Nottingham Building Society (NBS) in 1983. The system used was based on the UK's Prestelviewlink system and used a computer, such as the BBC Micro, or keyboard (Tandata Td1400) connected to the telephone system and television set. The system allowed on-line viewing of statements, bank transfers and bill payments. In order to make bank transfers and bill payments, a written instruction giving details of the intended recipient had to be sent to the NBS who set the details up on the Homelink system. Typical recipients were gas, electricity and telephone companies and accounts with other banks. Details of payments to be made were input into the NBS system by the account holder via Prestel. A cheque was then sent by NBS to the payee and an advice giving details of the payment was sent to the account holder. BACS was later used to transfer the payment directly.

After a test period with 2,500 users starting in 1994, online banking services were launched in 1998, using Minitel terminals that were distributed freely to the population by the government.

By 1990, 6.5 million Minitels were installed in households. Online banking was one of the most popular services.

Online banking services later migrated to Internet.

Around 1994, banks saw the rising popularity of the internet as an opportunity to advertise their services. Initially, they used the internet as another brochure, without interaction with the customer. Early sites featured pictures of the bank's officers or buildings, and provided customers with maps of branches and ATM locations, phone numbers to call for further information and simple listings of products.

In 1995, Wells Fargo was the first U.S. bank to add account services to its website, with other banks quickly following suit. That same year, Presidential became the first U.S. bank to open bank accounts over the internet. According to research by Online Banking Report, at the end of 1999 less than 0.4% of households in the U.S. were using online banking. At the beginning of 2004, some 33 million U.S. households (31%) were using some form of online banking. Five years later, 47% of Americans used online banking, according to a survey by Gartner Group. Meanwhile, in the UK online banking grew from 63% to 70% of internet users between 2011 and 2012.

Forex scandal

The forex scandal also known as the forex probe is a financial scandal that involves the revelation, and subsequent investigation, that banks colluded for at least a decade to manipulate exchange rates for their own financial gain. Market regulators in Asia, Switzerland, the United Kingdom, and the United States began to investigate the \$5.3 trillion-a-day foreign exchange market (forex) after Bloomberg News reported in June 2013 that currency dealers said they had been front-running client orders and rigging the foreign exchange benchmark WM/Reuters rates by colluding with counterparts and pushing through trades before and during the 60-second windows when the benchmark rates are set. The behavior occurred daily in the spot foreign-exchange market and went on for at least a decade according to currency traders.

At the center of the investigation are the transcripts of electronic chatrooms in which senior currency traders discussed with their competitors at other banks the types and volume of the trades they planned to place. The electronic chatrooms had names such as "The Cartel", "The Bandits' Club", "One Team, One Dream" and "The Mafia". The discussions in the chatrooms were interspersed with jokes about manipulating the forex market and repeated references to alcohol, drugs, and women. Regulators are particularly focusing in on one small exclusive chatroom which was variously called The Cartel or The Mafia. The chatroom was used by some of the most influential traders in London and membership in the chatroom was highly sought after. Among The Cartel's members were Richard Usher, a former Royal Bank of Scotland (RBS) senior trader who went to JPMorgan as head of spot foreign exchange trading in 2010, Rohan Ramchandani, Citigroup's head of European spot trading, Matt Gardiner, who joined Standard Chartered after working at UBS and Barclays, and Chris Ashton, head of voice spot trading at Barclays. Two of these senior traders, Richard Usher and Rohan Ramchandani, are members of the 13-member Bank of England Joint Standing Committee's chief dealers group.

At least 15 banks including Barclays, HSBC, and Goldman Sachs disclosed investigations by regulators. Barclays, Citigroup, and JPMorgan Chase all suspended or placed on leave senior currency traders. Deutsche Bank, continental Europe's largest lender, was also cooperating with requests for information from regulators. Barclays, Citigroup, Deutsche Bank, HSBC, JPMorgan Chase, Lloyds, RBS, Standard Chartered, UBS and the Bank of England as of June 2014 had suspended, placed on leave, or fired some 40 forex employees. Citigroup had also fired its head of European spot foreign exchange trading, Rohan

Ramchandani. *Reuters* reported hundreds of traders around the world could be implicated in the scandal.

The monetary losses caused by manipulation of the forex market has been estimated to represent \$11.5 billions-a-year for Britain's 20.7 million pension holders alone (£7.5B/year). The manipulations affected customers all around the world, for over a decade. The manipulations' overall estimated cost is not yet fully known.

On 12 November 2014, the United Kingdom's Financial Conduct Authority (FCA) imposed fines totaling \$1.7 billion on five banks for failing to control business practices in their G10 spot foreign exchange trading operations, specifically: Citibank \$358 million, HSBC \$343 million, JPMorgan \$352 million, RBS \$344 million and UBS \$371 million. The FCA determined that between 1 January 2008 and 15 October 2013 the five banks failed to manage risks around client confidentiality, conflict of interest, and trading conduct. The banks used confidential customer order information to collude with other banks to manipulate the G10 foreign exchange currency rates and profit illegally at the expense of their customers and the market. On the same day the United States Commodity Futures Trading Commission (CFTC) in coordination with the FCA imposed collective fines of \$1.4 billion against the same five banks for attempted manipulation of, and for aiding and abetting other banks' attempts to manipulate, global foreign exchange benchmark rates to benefit the positions of certain traders. The CFTC specifically fined: \$310 million each for Citibank and JPMorgan, \$290 million each for RBS and UBS, and \$275 million for HSBC.

The CFTC found that currency traders at the five banks coordinated their trading with traders at other banks in order to manipulate the foreign exchange benchmark rates, including the 4 p.m. WM/Reuters rates. Currency traders at the banks used private chatrooms to communicate and plan their attempts to manipulate the foreign exchange benchmark rates. In these chatrooms, traders at the banks disclosed confidential customer order information and trading positions, changed trading positions to accommodate the interests of the collective group, and agreed on trading strategies as part of an effort by the group to manipulate different foreign exchange benchmark rates. These chatrooms were often exclusive and invitation only.

On 20 May 2015, the five banks pleaded guilty to felony charges by the United States Department of Justice and agreed to pay fines totaling more than \$5.7 billion. Four of the banks, including Barclays, Citigroup, JP Morgan, and Royal Bank of Scotland pleaded guilty to manipulation of the foreign markets; while the others had already been fined in settlements from the November 2014 investigation, Barclays had not been involved and was fined for \$2.4 billion. UBS also pleaded guilty to

committing wire fraud and agreed to a \$203 million fine. A sixth bank, Bank of America, while not found guilty, agreed to a fine of \$204 million for unsafe practices in foreign markets.

On 18 November 2015 Barclays was fined an additional \$150m for automated electronic foreign exchange misconduct.

On 19 December 2014 the first and only known arrest was made in relation to the scandal. The arrest of a former RBS trader took place in Billericay, Essex, and was conducted by the City of London Police and the Serious Fraud Office.

Respective authorities have announced remediation programmes aimed at repairing trust in their banking systems and the wider foreign exchange market place. In the United Kingdom the FCA has stated that the changes to be made at each firm will depend on a number of factors, including the size of the firm, its market share, impact, remedial work already undertaken, and the role the firm plays in the market. The remediation programme will require firms to review their IT systems in relation to their spot FX business, as the banks currently rely on legacy technologies that allow for the existence of dark-data silos within which manipulation is able to occur unnoticed by compliance systems. In Switzerland the Swiss Financial Market Supervisory Authority has announced that for a period of two years UBS will be limited to a maximum annual variable compensation to 200% of the basic salary for foreign exchange and precious metals employees globally. UBS is instructed to automate at least 95% of its global foreign exchange trading, while effective measures must be taken to manage conflicts of interest with a particular focus on organisational separation of client and proprietary trading.

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